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TRANSACTIONS

OF THE

Sanitary Institute of Great Britain.

VOLUME V.

CONGRESS AT GLASGOW.

1883–4.

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Sanitary Institute of Great Britain.

Formation of the Institute.

The increasing importance attached to Sanitary Science and the recognised position it was assuming in the public mind, appeared to the promoters of the Sanitary Institute fully to justify the formation of a National Society, the object of which should be to devote itself *exclusively* to the advancement of all subjects bearing upon Public Health. In furtherance of the object, a meeting was held at St. James's Hall, on the 13th of July, 1876, at which His Grace the Duke of Northumberland presided, when it was unanimously resolved:—

First—"That in the opinion of this meeting the sanitary condition of this country is still very unsatisfactory, and that further legislation is necessary with a view to its improvement; and that for the purpose of collecting and imparting information upon all matters connected with the subject of 'Public Health' a Society be now formed, to be styled 'The Sanitary Institute of Great Britain.'"

Second—"That the gentlemen whose names are appended be requested to act as a Committee (with power to add to their number) for the purpose of carrying out the previous resolution and of reporting to an adjourned public meeting to be held during the second week in October next."*

The Committee appointed to report upon the subject considered it would add greatly to the usefulness of the Institute if Mayors of Boroughs, Chairmen of Local Boards, Sanitary Authorities, Medical Officers of Health, and all who have to administer the Public Health Acts, would associate themselves with the Institute, either in their individual or corporaté capacity, and take part in its proceedings. By thus bringing their united knowledge and experience to bear upon Sanitary matters, the laws relating to the same would become better known and be more efficiently administered.

Basis of the Constitution of the Institute.

Section I.

Charter of Incorporation, Membership, and Government of the Institute.

As soon as practicable a Charter of Incorporation shall be obtained, as it will facilitate some portions of the work of the Institute, more

* An adjourned public meeting was held on the 14th of March, 1877, when the report was unanimously adopted and a Council subsequently appointed to carry it into effect.

especially the examinations as set forth in Section II. Until a Charter is obtained, the examinations shall be continued as heretofore, and a Register of persons certificated as competent to act as Local Surveyors and Inspectors of Nuisances shall be formed.

The Institute shall consist of Fellows, Members, Associates, and Subscribers.

Fellows shall be elected by ballot by the Council, and shall include scientific men of eminence, persons of distinction as Legislators or Administrators, and others, who have done noteworthy Sanitary work.

All Fellows (except those who have already become Life Members) shall pay a fee of Ten Guineas on taking up the Fellowship, and such fee shall entitle the Fellow to all the privileges and advantages of the Institute for life without further payment.

Any person proposed by three Fellows or Members, shall be eligible for election as a Member of the Institute.

Members shall be elected by ballot by the Council, and shall be eligible to serve on the Council, and to vote at all Elections and Meetings of the Institute. The admission Fee payable by a Member shall be Three Guineas, and the Annual Subscription Two Guineas.

Medical Officers of Health and Medical Men holding Certificates in Sanitary Science from any University or Medical Corporation shall be entitled to be enrolled as Members of the Institute without Admission Fee.

Members desirous of becoming Life Members may do so on payment of Ten Guineas in lieu of the Annual Subscription.

All persons who have passed the Examination and received the Certificate for Local Surveyor from the Institute, shall, by virtue of having so passed, become Members of the Institute upon the payment of Five Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

Any one proposed by two persons, either Fellows, Members, or Associates of the Institute, shall be eligible to be elected as an Associate of the Institute, the election to be by ballot by the Council. The Admission Fee payable by Associates shall be Two Guineas, and the Annual Subscription One Guinea.

All persons who have passed the Examination and received the Certificate for Inspector of Nuisances from the Institute, shall, by virtue of having so passed, become Associates of the Institute upon the payment of Three Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

Persons of either sex, interested in the advancement of Sanitary Science, shall be entitled to be enrolled as subscribers on payment of One Guinea annually. Annual Subscribers shall be entitled to attend and to take part in the discussions at all meetings and Congresses of the Institute, and shall have free admission to the Conversazioni and Exhibitions of Sanitary Appliances held in connection with the Institute, so long as they continue to pay their Subscription.

Donors of Ten Guineas and upwards shall be entitled to be enrolled as "Life Subscribers," with all the privileges and advantages of Annual Subscribers without further payment.

Subscribers of Half-a-Guinea to any Congress of the Institute shall be entitled to a card of admission to the Meetings, Addresses, Conversazioni, Excursions, and Exhibition held in connection with that Congress.

The Institute shall be governed by a President, Vice-Presidents, and a Council of Twenty-four, consisting of Fellows and Members of the Institute, of whom not less than two-thirds shall be Fellows. The Council shall be chosen by the Fellows and Members. One-fourth of the Council shall retire annually, and shall not be eligible for re-election for one year.

The first President of the Institute shall be His Grace the Duke of Northumberland. Future Presidents and Vice-Presidents shall be elected by the Council. The Council shall have the power of electing Honorary Members of the Institute, Honorary Foreign Associates, and Corresponding Members of the Council.

Section II.

Objects of the Institute.

To devote itself to the advancement of Sanitary Science and the diffusion of knowledge relating thereto.

To examine and to grant Certificates of Competence to Local Surveyors and Inspectors of Nuisances, and to persons desirous of becoming such or of obtaining the Certificate. The Examinations shall be held at such times and in such places as the Council may direct.

A Board of Examiners shall be appointed by the Council; such Board shall consist of gentlemen representing Medical, Chemical, and Sanitary Science, Engineering, Architecture, and Sanitary Jurisprudence.

The Examination for Local Surveyors shall include a competent knowledge of the Statute relating to Sanitary Authorities, of Sanitary Science and Construction, and of Engineering.

The Examination for Inspectors of Nuisances shall comprise the elements of Sanitary Science, together with Sanitary Construction, and the Statutes relating to the prevention of disease and the suppression of nuisances injurious to health.

Fees shall be charged for the Examinations, and a Certificate of Competence, signed by the Examiners, shall be granted to successful candidates, entitling them to be designated as "Certificated by the Sanitary Institute of Great Britain."

A Congress shall be held by the Institute for the consideration of subjects relating to Hygiene at such times and places as the Council may direct.

Exhibitions of Sanitary Apparatus and Appliances shall be held from time to time as the Council may direct.

Fellows, Members, Associates, and Subscribers shall have the right

of Free Admission to the Exhibitions of the Institute whenever they are open. All fees payable by Exhibitors and the Public shall be fixed by the Council and belong to the Institute.

A Catalogue shall be published under the direction of the Council as a permanent record of the Exhibitions.

The Institute shall take such steps as may be within its power to obtain a complete registration of sickness, especially of preventable diseases.

The Institute shall endeavour to secure the services of medical men and others specially qualified to give lectures on subjects relating to the prevention and spread of disease.

The Institute shall encourage the formation of classes for technical instruction in Sanitary Science in such a way as may seem advisable to the Council.

A Library shall be formed in connection with the Institute.

ANNUAL REPORT OF THE COUNCIL

FOR 1882–3.

In presenting this the Sixth Annual Report to the Fellows and Members of the Institute, the Council would remark that the objects of the Institute are being gradually attained, and they are glad to record marked progress in the Examinations and Exhibitions.

The Anniversary Meeting of the Institute was held in the Theatre of the Royal Institution, by the kind permission of the Board of Managers, on July 13th, 1882. His Grace the Duke of Northumberland, President of the Institute, occupied the chair, and a paper on "The Work of the Sanitary Institute of Great Britain," was read by E. C. Robins, F.S.A., F.R.I.B.A. The paper has been published in Vol. III. of the Transactions of the Institute.

The Fifth Autumn Congress of the Institute was held at Newcastle-upon-Tyne from September 26th to 30th by invitation of the Mayor and Corporation. Captain Douglas Galton, R.E., C.B., D.C.L., F.R.S., presided. The papers read at the Congress, which have been published in full in Vol. IV. of the Transactions, are well worth the careful attention of the Members. A very large amount of interest in the meeting was shown both by the Metropolitan and Provincial Press, and the papers and discussions were reported by them at more than usual length.

Several well-arranged Excursions were held in connection with the Congress, especially one to Alnwick Castle, by the invitation of His Grace the Duke of Northumberland, President of the Institute, at which about 250 persons were present.

The Exhibition was very satisfactory, and, in many respects, the best, although not quite the largest that has been held by the Institute. There were 110 exhibitors and 600 exhibits; 12 Medals, besides the Richardson Gold Medal, which had not been awarded since 1878, and 70 certificates were awarded at the close of the

Exhibition, and 37 exhibits were deferred for further practical trial; the result of these trials will be made known, and the medals and certificates will be presented, at the Anniversary Meeting in July next.

The Exhibition was visited by 8,373 persons.

During the year two Examinations for Local Surveyors and Inspectors of Nuisances were held by the Institute. At the Examination in June, thirteen candidates presented themselves, four for Local Surveyors and nine for Inspectors of Nuisances. Two candidates were Certificated as competent to discharge the duties of Local Surveyors, and eight as competent to discharge those of Inspectors of Nuisances.

At the Examination in November, eight candidates presented themselves, two for Local Surveyors, and six for Inspectors of Nuisances; one candidate was certificated as competent to discharge the duties of Local Surveyor, and five as competent to discharge those of Inspectors of Nuisances.

The Council are glad to report that there is a steady increase in the numbers attending the Examinations, and in the towns and corporations who recognise the value of the certificates granted by the Institute.

The Council much regret that they have to report the death of Dr. William Farr, C.B., D.C.L., F.R.S., the most eminent statistician of all matters relating to public health, who materially assisted in the inauguration of this Institute, and was from the first one of the Vice-Presidents, and of Major-Gen. H. Y. D. Scott, R.E., C.B., F.R.S., a former Member of Council. Votes of condolence and sympathy with the relatives were unanimously passed at the meeting of Council on April 26, 1883. They have also to regret the death of Dr. T. Moffat, Fellow, and of Dr. R. Elliot, W. Molyneux, and Dr. Prall, Members.

There have been elected since last Annual Meeting 3 Fellows, 20 Members, and 7 Associates. The numbers now on the Roll of the Institute are 88 Fellows, 192 Members, 20 Associates, 21 Subscribers, and 30 Honorary Foreign Associates. Total, 351.

The retiring Members of Council this year are Henry C. Burdett,

F.L.S., F.S.S., T. W. Grimshaw, M.A., M.D., James Lemon, M.I.C.E., F.R.I.B.A., F. Maxwell Lyte, F.I.C., F.C.S., William Ogle, M.A., M.D., and The Rev. F. Temple, D.D., Lord Bishop of Exeter.

Vol. III. of the Transactions has been published during the year. The interest of the volume is well kept up by the papers, and abstracts of papers, read at the Ordinary Meetings during 1881 and 1882, with the long discussions upon them.

Vol. IV. has also been published, and contains an account of the Congress and Exhibition at Newcastle-upon-Tyne in 1882.

The proposed Government measure for the municipal government of the metropolis was considered so important by the Council that they have sent a communication to the Home Secretary suggesting that provision should be made in the bill for securing proper qualifications on the part of Sanitary Officers appointed under the Act.

The Council have now under consideration the question of the notification of infectious diseases, and are collecting information from those towns where compulsory regulations are in force, with a view to holding a Meeting of the Institute to discuss the subject.

The Congress and Exhibition this year will be held at Glasgow, an invitation from the Lord Provost and Town Council having been accepted during the Meeting at Newcastle. The Council confidently hope that the visit to this one of the most important towns in the kingdom, will prove to be the most successful of the Congresses, not only in the value of the papers and the success of the Meeting, but also in assisting the general advance of the interests of the Institute. Under these circumstances the Council rely on a full attendance of members.

SANITARY INSTITUTE

Abstract of Cash Receipts and Payments

	£ s. d.	£ s. d.
To Balance at Bankers as per Pass-Book of the Institute, December 31st, 1881, viz.:—		
Wyatt Edgell Fund	200 0 0	
General Account	49 9 1	
		249 9 1
To Fellowship Fees	63 0 0	
„ Admission Fees	43 1 0	
„ Life Compositions	46 4 0	
		152 5 0
„ Annual Subscriptions		160 13 0
„ Examination Fees		37 16 0
„ Sale of Publications		10 19 2
„ Loan from Members of Council ..		100 0 0
„ Report on Sanitary Exhibition ..		47 0 0
		£758 2 3

EXHIBITION

	£ s. d.
To Balance 1st of January, 1882	52 3 8
„ Receipts	488 3 4
	£540 7 0

Audited and found correct with the books of the Institute,

MAGNUS OHREN,
ERNEST TURNER, } *Auditors.*

April 28th, 1883.

OF GREAT BRITAIN.

for the Year ending 31*st December*, 1882.

	£	s.	d.	£	s.	d.
By Expenditure :—						
Office Furniture..	11	12	10			
Rent and Taxes	52	2	0			
Salaries and Wages	154	5	0			
Postage, Telegrams and Carriage	31	11	4			
Incidental Expenses	39	7	0			
Stationery and Printing ..	29	2	9			
Ordinary Meetings	31	11	0			
Examination Expenses	37	5	3			
Library	2	6	1			
Congress	87	12	8			
				476	15	11
„ Wyatt Edgell Prize				200	0	0
„ Report on Sanitary Exhibition ..				47	0	0
„ Balance at Bank December 31st, 1882				34	6	4
				£758	2	3

ACCOUNT.

	£	s.	d.
By Expenditure	281	14	4
„ Balance at Bank December 31st, 1882	258	12	8
	£540	7	0

NOTICE.

The Institute, as a body, is not responsible for the facts and opinions advanced in the Addresses and Papers published in its Transactions.

THE RELATIONSHIP BETWEEN GEOLOGY AND SANITATION.

ADDRESS BY W. EASSIE, C.E., F.L.S., F.G.S.

Anniversary Meeting, July 12th, 1883.

THE few remarks which I shall have the honour of making to-day in your presence, will bear upon the relationship between Geology and Sanitation, or what would broadly be called Health. They will in no way treat upon the relationship between Geology and Sanitary Engineering, or any of the remedial measures taken from time to time by man, to counteract any unhealthy Geological surface presentations. To follow out my subject faithfully, I must also eschew all matters connected with Botany, *per se*, although I may be obliged to refer occasionally to some actions of vegetation, which may affect the healthy conditions of some Geological underground formations and superficial deposits. Neither do I consider it within the province of my subject to deal with Meteorology or with Climatology, because the relationship of these subjects to Health are vast, requiring independent treatment, which I trust they will receive at the hands of the distinguished members of the Meteorological Society, who are now members of our Institute. I take it for granted that the earth was made for man, and not man for the earth, and inasmuch as the earth is simply a speck, or almost so, in our solar system, the relationship between Health and the Meteorological laws bearing upon our earth's crust, really call for a separate grand division of our subject.

I only seek in this short address to present you with a few instances where Geology becomes the handmaiden of healthiness, or otherwise, to the beings born upon its surface; and the time at my command will not allow me to treat of any of the modes in which our terrestrial habitation is fouled by its present or past possessors. I shall say as little as possible upon Mineralogy, although it is very intimately bound up with the lithological character and constitution of our rocks.

With Geology, as a producer of stone, slate, and other substances which go to make up our habitations and pave our

streets, and so forth, I have nothing to do. Neither can I treat its relation to the Soil, its mechanical relations, density, division, adhesive power, capacity of attracting and holding air, of containing water; its capillary power, its relation to the atmosphere, its relation to heat, and its power of retention of the same. We have nothing to do either with the application of chemistry to Soils, or as to whether they may contain anything inimical to vegetation, or be, agriculturally speaking, short of any factors for general usefulness. We have nothing to do with the improving and enriching of soils by chemical or natural applications, or with the mixing of certain clays with soils and sands; with their pauperization by too frequent cropping, or with the improvements made possible in them by means of weeding and draining. All we need now take into consideration is where Geology and Health-essentials come into natural contact.

Without going into the question of food production in any detail, there can be no doubt that a man's health depends upon the kind, quality, and quantity of the food which he consumes, and inasmuch as all foods are derived from the earth—whether animal or vegetable—and are obtainable according to the rate of production, it may be wise to consider for a moment the very wonderful powers which some strata possess over others.

Let us consider agriculture only. The student will find that the productiveness of soils, as remarked by Mr. Chambers, has no relation to the Chronological succession of the various formations.

"The mere Geological composition of soils afford no very reliable criterion of economic value. The same rock that produces the almost barren soil of Argyllshire, weathers into the fertile soil of the Channel Isles, and to the Old Red Sandstone is due at once the rich soil of Hereford and Monmouth, &c, and some of the most barren heaths and moors in Scotland."

The bulk of the tertiary formations are, however, very fertile. With regard to the thin soils overlying the chalk, they are of little value and do not retain moisture. When the chalk, however, is found naturally covered to some depth, with sands and clays, considerable fertility results. The Lias and Oolitic formations furnish valuable clays of great richness, but they require considerable labour and attention.

Perhaps the highest per centage of valuable land is found associated with the Old Red Sandstones, and Limestones, and Marl beds. The same may be said of the Mountain Limestone and New Red Sandstone. As for the igneous rocks, though exhibiting much fruitfulness where well disintegrated, their value, as a food producing superficies, is not great.

Changing the subject, let us now regard the kinds of formation chosen by the earliest civilized people in, for instance, our own country. We shall find this of interest. It has been truthfully observed by Mr. Topley, of the Geological Survey, that the outcroppings of divers Geological formations, "are marked by the occurrence thereon of numerous villages, whilst certain neighbouring formations are almost without any." Mr. Prestwich remarks that London was first peopled upon its gravel bearing surfaces, because these readily yielded good water. Where the eastern part of Northumberland, says Mr. Topley, presents isolated areas of a certain Sandstone, these rocky patches contain the ancient villages and most important hamlets. This was because the soil was dry, and pure springs occurred at the edge of the clay. Of course, the sites of more modern villages have been chosen because of the underground mineral wealth, but this is only a further instance of the power exerted over man by Geology. In the district alluded to, out of twenty-three villages, thirteen were at first built upon rock, six upon sand, and only one upon clay. Elsewhere he shows that narrow bands of clay are rarely found to be the sites of villages, and houses are even scarce; also that while wide clay areas are sparsely populated, on the intermediate formations of sand and Limestone, villages abound. It will also be found that a "relation exists between the boundaries to which these villages give their names, and the great physical features caused by the outcropping of certain strata." It appears absolutely certain that the land divisions of the south-east of England, have a well marked and constant relation to these great physical features. The position of the parishes was not the result of accident, or according to an order from Church or King, but resulted from these same great physical features. It has also been remarked by another author, that "no less than nineteen of the largest and most important towns in England, from Exeter to Carlisle, are all situated along the line of one Geological formation, the New Red Sandstone, which, in addition to its own mineral treasures of rock, salt, gypsum, soda, and metalic ores, usually covers the invaluable deposit of coal, at once yielding an incentive and supply to the vast and enterprising population of this favoured district." Here is another case where Geology directly affects the habitat and condition of man.

When Geology was comparatively a young Science, it was nevertheless common to compare the chalk with its clean soil, clear air, and pure water, to the foggy atmosphere and impure water supply of the London clay. The dry nature of a sandy soil, was also compared with the moisture and malaria of a

marshy district. This was first observed by Mr. G. F. Richardson and comprehended pretty much all that Geology was supposed to have in common with Public Health. Since then, however, we have begun to particularise. For instance, we say, that buildings erected upon the Limestones, such as the Mountain Limestone, and the Oolitic Series and on well-drained sands, are built upon dry ground. If built on the Marlstone, the subsoil would be termed more moist—if built on the Lias or alluvial ground, the soil would be denominated a damp one.

It should be borne in mind, that throughout this paper, I have, on nearly every occasion, when quoting an Author, been obliged to condense his remarks into the smallest possible space, I trust without spoiling the sense.

But there is one passage which I must, perforce, quote in full, it is so true, and so suggestive, and bears considerably upon our subject, because there can be no health, as Juvenal suggests, unless there be a sound mind in a sound body.

The sentence was written by Mr. G. F. Richardson, and is as follows, "The moral and social feelings of the inhabitants of particular districts are alike influenced by Geological situation; and the enterprise of the islander and the local patriotism and attachment to home of the mountaineer, and the native of primary districts, are (often without the consciousness of the parties themselves) inspired by the physical geography of their native region."

Such an argument as the above, but with a more direct bearing upon our subject, might be reasoned out in respect of the various classes of workers, which are associated with divers Geological Formations. In the huge iron districts, where coal and iron abound, where men—day workers and all night workers—are herded together in the smallest possible space, so as to be near their furnaces and rolling mills, one would not expect to find the robust health and longevity enjoyed by the fishermen on the sea coast. Neither would one look for a community of husbandmen upon hills formed of hard slaty rocks, with scarcely any soil upon them, on account of their great resistance to decomposition. Thus upon the granitic formations, which have never been abraded, or been covered during the glacial era with many kinds of soils—as in the case of the Highlands of Scotland—one would expect to discover little else than wild game.

It is very different in the case of the great central valley of Scotland, termed by Professor Ramsay, one of the most fertile areas in Great Britain; here are farmers by the thousands, and the highest condition of agriculture. It is curious also to note, that upon the Old and New Sandstones and Marls in Devonshire, Herefordshire, and Gloucestershire, &c., where many

crops are grown, the above districts are termed the great tree districts of Great Britain, and are famous for apples and pears. Those healthy beverages, cider and perry, so largely consumed by the agricultural population, have, therefore, a direct association with the characters of the rocks, seeing that they will not flourish upon other soils. It is another very curious fact, that the plain of the Carse of Gowrie, also famous for its apples, is situated over a tract of the Old Red Sandstone.

It is singular, taking England as an example, that the distribution of certain diseases largely depends upon the absence or otherwise of valleys and rivers, along which the winds can sweep without interruption, in other words, upon the physical conformation of our Island, as it was left at the end of the last Geological epoch, when it became fit for the residence of man. I will mention one or two instances, and the lessons which they teach would amount to this, that before making choice of a locality for people subject to certain ailments, it is wise to take its Geological structure into consideration. Dr. Alfred Haviland says, after years of study on this matter, that "those coastal counties most exposed to the prevailing winds, and most free from obstructions to their full operation, have the least mortality"—due to heart disease—"whereas those coastal counties, such as those along the South Coast, which have barrier-like rocks, and other characters which tend to interfere with the full sweep of the sea winds, are those which have a high mortality." Where the precipitous and wall-like rocks are intersected by every variety of sea inlet, opening into wide valleys through which the winds can scour along, there is a lower mortality. He also remarks that "coincident with the lowest exposure to the sea, as in the Midland counties, is the highest mortality of heart disease in those counties, and the lowest amount of mortality is coincident with the greatest amount of exposure. The counties which lie intermediately between these extremes, have also an intermediate amount of death rate." His conclusions have been worked out with the extremest care, accompanied with maps. As an example, it may be instanced that the East Yorkshire group of counties, which is bound by a precipitous coast of Oolite and chalk cliffs, say from Whitby to Bridlington Bay, and has no sea inlets, with an inland directed water shed, these counties have a high mortality. The low coast of sea-board between Bridlington and the Isle of Sheppey, differently situated in respect of offering no check to the winds, has a very low mortality. These conclusions are well worthy of attention and are of serious moment, seeing that the mortality from heart disease and dropsy, amount to more than one seventeenth part of the

mortality from all causes. London, as a division, has a low mortality, and coincident with this, it is traversed by the great sea inlet, the Thames, with a twice a day average rise of the tide, between sixteen and twenty feet.

About fifteen years ago, Dr. Buchanan examined three of the Southern counties of England, with regard to the distribution of phthisis or consumption, and without going into the details of his report, I will give his conclusions which are as follows:—

"Within the counties of Surrey, Kent, and Sussex, there is, broadly speaking, less phthisis among populations living on porous soils, than among populations living on impervious soils."

"Within the same counties there is less phthisis among populations living on high-lying pervious soils, than among populations living on low-lying pervious soils."

"Within the same counties there is less phthisis among populations living on sloping impervious soils, than among populations living on flat impervious soils."

"The whole of the foregoing conclusions combine into one—which may now be affirmed generally, and not only of particular districts—that, wetness of soil is a cause of phthisis to the population living upon it."

Dr. Haviland, a few years ago, writing upon phthisis in females, says that "the warm fertile ferruginous Red Sandstone tracts of country are remarkable for forming the sites of the most extensive series of low mortality groups throughout England." The high elevated ridges of non-ferruginous and unfertile carboniferous limestone and coal, and the elevated, hard, unfertile non-ferruginous silurian for the sites of the most extensive series of high mortality groups."

It is pleasing to know that the truthfulness of the above has been proved by the great lowering of the death rate where districts have been sewered and drained. Dr. Buchannan is a cloud of witnesses in himself upon this point. Dr. Wilson has also stated that in the Kelsoe district, fever and ague, which formed nearly one-half of the diseases of the population, almost wholly disappeared in ten years, consequent upon the general extension of an efficient drainage through the neighbouring country.

Passing to the subject of Cholera visitations and their relationship to certain subsoils, some curious facts present themselves. I would prefer for the present to consider Malaria and Cholera in the one group, seeing that there are certain Geological associations. In manifesting partiality for the alluvium of the River Ganges, say Drs. Lewis and Cunningham in 1878, Cholera is not singular. Malaria and kindred diseases flourish

about the deltas of large rivers everywhere. Malaria, they continue, resembles Cholera markedly in this, that in many localities, such as the swamps of South Australia, both are equally unknown. The distribution of Malaria is not less inexplicable than that of Cholera, as for example, its occurrence in the Oases of the Desert Sahara, in North Africa. They further add that the history of Cholera throughout India presents one common feature, and that it can only be fairly regarded as endemic in such localities as manifest a close resemblance to the more superficial layers of their Geological formation.

In 1832, when Cholera first appeared in Paris, M. Boubeé, after long researches satisfied himself that there was an essential connection between the geological condition of the earth, and the tendency manifested by Cholera to devastate certain parts, while it left others untouched. He says further, that in countries where endemic diseases exist, as in those where epidemics were frequent, he found that the disease in almost every country, was limited by the area of the geological formation, and that each geological basin constituted a natural seat for morbid affections—in short—that the "Medical constitution" of every country depended on its geological constitution, in all cases where this Geological constitution showed a distinctly traced character. The Cholera in Paris was most virulent and most marked in those parts where there were tertiary or alluvial strata, and it made but little progress, if any, in those countries where there existed non-absorbing rocks. He gives several curious facts in support of this theory. For instance, in Lyons there were fatal cases only in one faubourg, and that occurred on diluvial soil. But owing to the rest of the town being partly built of granite and standing upon it, these portions escaped. The same association between soils encouraging evaporation and exhalation was noticeable during an outbreak of Cholera at a place in Brittany, and it was discovered, that there exists there a little basin of tertiary strata, not found elsewhere, and moreover, the whole soil of the place attacked is covered with diluvial deposit.

I think it may be taken for granted that the districts ravaged by cholera will be found Geologically wanting, in some healthy factor or another, permitting the subsoil to be loaded with organic matter. Going to the head-quarters of Cholera, for instance, Calcutta, we shall see that the soil is of a very peculiar character, unfitted to yield good drinking water. Mr. Blanford describes it as a mixture of firm sand and clay, with decayed animal and vegetable matter, also loam, very much like the silt that settles from the water of a muddy river.

Following this, at a distance averaging eight feet, is a bed of stiff clay, and below this again is a layer of peat, resting on alternating layers of sand and clay.

The Hindoos, however ancient and learned a people, never understood Geology, or they would never have laid down the lines of a city on such a soil without at least draining it. Even in our own country, where we are bound to reside upon the clay, as in the case of overgrown London, it is unsafe to build upon our pure clays without covering the site of the house with a few inches of concrete.

Just one word upon clay, as there are clays and clays. The London, the Wealden, the Lias, Carboniferous, and Silurian clays all vary in composition and in density. There is one capital method of discovering whether a soil is a clay loam, a strong clay, or a pure clay. If 100 grains of the soil be treated, and leave from 40 to 70 grains of clay, it is a loamy soil, if from 70 to 85, it is a clay loam, if from 85 to 95, it is a strong clay soil, and when no sand can be separated it is a pure clay.

It would be impossible in the time allotted to me to do more than merely hint at some of the relationships between Geology and the causes of disorders. I will name a few promiscuously. Take, for instance, the effect of damp soils upon health. These soils are cold, and cause a mistiness in the air, inducing, when worst, catarrhs, rheumatism, and neuralgia. Moreover, the emanations which reach the surface are of an unhealthy organic character.

When active Geological changes ceased, when the earth became fit to receive life—and it is in the same condition at the present time as regards the height of its hills, the depth of its valleys, and the width of its river-beds—nature had always provided, with rare exceptions, for the removal of water to the nearest stream, and if this natural flow be impeded, in the case of wet soils, paroxysmal fever follows. An instance of this occurred at the making of the Ganges and Jumna canals, and many other similar cases could be related.

Drs. Parkes and de Chaumont have mentioned some of the soils which have been known to evolve the agent which produces periodical fevers in malarious districts. These are marshes, alluvial soils, soils of tropical valleys, sandy plains, certain granitic and metamorphic rocks, and iron soils. With reference to the last mentioned, Sir Ronald Martin has directed attention to the fact, that many reputed malarious soils contain a large proportion of iron. The direct association of the two deserves further examination.

The soil of the Roman Campagna, which so abounds with malaria, fever, and so on, is very shallow, and rests upon about

seven feet of that peculiar substance called tufa, and this again upon other volcanic materials. There is, therefore, no subsoil, and no chance of circulation for air or water. When the heavy rains fall the water rests on the bed of tufa, which is impervious, and generates the unhealthy mists prevalent there, which I have myself witnessed. When the drought comes, the soil is perfectly baked. Even if the soil itself were uncontaminated, acqua-malarial fevers would ensue.

It is very curious to note that, although Geology has produced such an insalubrious area, she has provided the cure for it. This the monks of La Trappe have discovered, *viz.*, by boring holes into the deposits of tufa, placing dynamite in them, and exploding this substance by electric conductors. In a very few days after these explosions, a good subsoil has been established at a small cost.

It would he impossible to give a list of the malaria and ague-producing sites and their peculiarities, in such a short paper, and I will only mention one, because I suffered from it myself. I foolishly slept outside the closed tent, somewhat nearer the Jordan than my friend, a London physician and the servants, and the result was, that I caught a peculiar fever, which took me three months residence in Alexandria to throw off sufficiently to enable me to travel. Portions of the plains of Troy, I know personally, are also active in producing ague; and it is comical to see what a quantity of quinine the herdsmen will put away when they get the chance, which is very rare.

It is well known that health is greatly effected by the kind of water prevailing in districts; and here again, there is an association between Health and Geology. Of the two waters, hard or soft, the soft one is purer. Water of considerable hardness may be drunk with impunity, but when the carbonate of lime, &c, from the Mountain Limestones, Chalks, &c, are very abundant—although they are the least injurious of the ingredients which make water hard—they exercise a certain prejudicial effect upon man and beast. Drs. Parkes and de Chaumont observe, that dyspepsia in the form of constipation or diarrœha follow the use of certain hard waters. Dr. Sutherland discovered that the hard water of the New Red Sandstone Rocks, formerly much used in Liverpool, also deranged the system, and, according to Dr. Leech, the substitution of soft water for hard water in Glasgow lessened derangements there. It is said that horses even, regularly using hard water, suffer from an abnormal growth of bone, and a spoiling of the skin. Calculi are also generally believed to be formed by drinking hard water, and cured by a substitution of soft water. There can be no doubt that the Geological features of a country

exercise considerable influence over the inhabitants who drink the water flowing from them. Mr. Grange has shewn that goître is a malady peculiar to districts where magnesian rocks exist, and that where consequently the water holds magnesia in solution. Drs. Parkes and de Chaumont have shown that certain drinking waters produce goître, and that when pure water is used the malady mostly disappears.

The characters of waters so variously affecting the health, depend entirely upon the Geological association of rocks, and it would not be a waste of time to take a hurried glance over the fields of hard and soft water-sheds in Great Britain.

Professor Ramsey points out that the waters of the Scotch rivers are soft, and especially the waters in the Highlands are soft, owing to the fact of the mountains being composed of granite, mica, &c, and the other rocks being also, with some exceptions, almost free from carbonate of lime. The waters from the Welsh mountains are chiefly from the Silurian rocks, containing little lime, and are, consequently, for the greater part, soft. The purest supply in our country is that derived from the primary rocks, which hedge in Lock Katrine, and which water now supplies Glasgow city. The waters of Bala Lake are also so pure, soft, and sweet, that it has been proposed to bring them to London. Waters which drain large areas of carboniferous limestone are always hard, and the same is true of the chalk formation, as well as of the Lias and Oolites which largely contain limestone. On the Old Red Sandstone areas containing limestones or cornstones, the water is likewise hard.

Waters drawn from alluvial ground are great in quantity, but the quality is very rarely commendable. My friend, Mr. Bristow, F.R.S., mentions a case near Bath, where large trees were found beneath an alluvial red loam. The presence of these soft, perished old world trees is not in favour of a well, and good water is never found in their vicinity. Great care should also be exercised when building over rocks with large fissures running through them.

One must notice the mineral waters, thermal or otherwise, with their strong medicinal powers, but I will be very brief. How they obtained their chemical constituents is a formidable enough question to answer, but a still more difficult one is how the hot mineral waters used for baths were produced, whether by chemical agency underground, by volcanic proximity, by internal heat of the earth, or by electrical changes. Natural hot waters have at all times been preferred to artificial waters for baths, and besides waters bubbling up from the earth, there are also the mud baths of Germany, mud rich in active agents, and used for baths and fomentations.

The mineral waters used for drinking purposes are equally valuable in disease and health, and the use of the sulphur, the saline and chalybeate waters are known to everyone. In Great Britain we lack only one class of mineral waters altogether, and that is the carbonated class which are so highly charged with carbonic acid. It is to be questioned whether the Geological conditions of the neighbourhood of the Spas, have not much to do with the benefit derived by their visitors, for there are more marked results when the waters or salts are used there, than when made use of at a distance.

Salt, which is the only mineral food of man, and which, in the shape of a condiment, forms the only replenishment to the blood, of the saline particles eliminated from it, in the bile and in tears, &c, it would be ungrateful not to give Geology the credit of. Salt can be obtained from sea water, but it is coarse compared with that of brine springs and rock salt. It is met with in rocks of every age, but chiefly in the New Red Sandstones, pebbly conglomorates, and in the variegated shales and marls.

Geology should also be credited with the conversion of those metallic elements which are used in medicine. Of the sixty-three known elements, says Dr. Attfield, thirty-nine are of medical or pharmaceutical interest, and of these about two-thirds are metals derived from the earth. In our pharmacopœia, one hundred and twenty-one different plants are used, but considerable use is made as well of the metals, iron, lead, zinc, antimony, and others. We need say nothing of the benefits derived by medicine from the sedimentary rocks, such as lime, chalk, fullers' earth, and a score of other things.

THE COMPULSORY NOTIFICATION OF INFECTIOUS DISEASE.

PAPER BY PROF. W. H. CORFIELD, M.A., M.D. (OXON.)

Ordinary Meeting, July 24th, 1883.

THE subject of "The Compulsory Notification of Infectious Disease" is one of so much importance, and one upon which there is such a large amount of controversy, that the Council of the Sanitary Institute thought it would be well to devote a meeting to the discussion of the subject, and asked me to prepare a paper to bring the matter forward.

To enable me to give the most practical information on the subject, I sent the following series of questions to the medical officer of health of each of the towns in which compulsory notification is in force, asking for particulars as to the working of the Act :—

Re COMPULSORY NOTIFICATION OF INFECTIOUS DISEASES.

1. Name of District?
2. Population Census, 1871? and 1881?
3. How long has the notification of infectious diseases been compulsory in your district?
4. What diseases are included under the Regulations?
5. Is the notification compulsory on the medical officer, or on the householder, or on both?
6. Is any fee, and, if so, what, paid for the notification, and to whom?
7. What are the penalties provided for failing to notify?
8. In how many cases have these penalties been enforced?
9. Has there been any opposition to the Regulations either before they were in force or since? If so, what was the nature of such opposition, and by whom was it made?
10. Are the medical men opposed to the Regulations, or do they heartily co-operate in carrying them out?
11. Have any cases of concealment of diseases, due in your opinion to the existence of the Regulations, come to your knowledge? If so, give a brief account of them.
12. How many cases of infectious diseases were notified to you on an average annually during the (say) 10 years before the Regulations came into force?
13. State also the number for each disease, and for each year separately if possible.
14. State the corresponding numbers for each year since the Regulations have been in force.
15. What was the average annual zymotic death rate for (say) 10 years before the Regulations were in force, and what has been the corresponding death rate since?
16. Are you of opinion that by means of the Regulations you have obtained (*a*) earlier information of the existence of cases of infectious

diseases, (*b*) information of the existence of cases that would not otherwise have been reported to you?

17. Have the Regulations assisted you in tracing the origin of any outbreak of infectious disease?

18. State briefly your general opinion as to the results produced by the enforcement of the Regulations, and add any information that you think may assist the investigation.

To these questions I received replies from eighteen different towns, viz.:—

Birkenhead,	Huddersfield,	Stafford,
Blackburn,	Leicester,	Staleybridge,
Bolton,	Newcastle,	Warrington,
Bradford,	Norwich,	Aberdeen,
Chadderton,	Nottingham,	Dundee,
Derby,	Preston,	Edinburgh,

and it is chiefly to these replies that I propose to confine my remarks.

The answers to the principal questions have been tabulated, and are given at the end of this paper (p. 42).

The time that the Compulsory Act has been in force in the several towns varies from six months at Newcastle-upon-Tyne up to five years and six months at Bolton, and at Huddersfield partially for six and a half years, but only satisfactorily for two and a half years. In eleven of the towns the Act has been in force over two years, and in only two under one year.

The population of the eighteen towns, according to the census of 1881, varied from nearly 17,000 at Chadderton to 228,000 at Edinburgh, and amounted to over 100,000 in nine towns out of the eighteen. (See Table A.)

In the regulations in force in the different towns, twelve diseases altogether are mentioned (see Table B). Small-pox and scarlet fever are included in all the eighteen towns; diphtheria, typhus, and enteric fever in seventeen; cholera in fifteen; puerperal fever in eleven; relapsing fever in ten; measles and continued fever in four; whooping cough and erysipelas in two. The regulations therefore are chiefly confined to eight diseases.

In Birkenhead the Act provides for small-pox, fever, cholera, or "any other dangerous infectious disease." This the Health Committee interprets as small-pox, measles, scarlatina, diphtheria, fevers, and cholera.

At Bolton measles and continued fever were included at first, but not afterwards.

At Huddersfield the Act gives power to add other infectious diseases to the list.

At Nottingham the Act is only in force for one year as a trial, and the list includes only small-pox and scarlet fever.

At Dundee the list includes nine diseases (measles, whooping cough, and erysipelas being omitted), and there is also power to add "such other diseases as the Commission may declare to be infectious."

By reference to Table C., it will be seen that in eleven of the towns it is compulsory on both the medical attendant and householder to notify an outbreak of any of the diseases to which the Act applies in the particular town.

In six towns the medical officer only is compelled to do so.

In one town only, viz., Nottingham, it is compulsory on the householder alone, but the medical attendant has to give a certificate to the householder. In Bradford the notification is compulsory on both, but the medical attendant need only hand the certificate to the householder.

At Birkenhead it is compulsory on the householder, but as soon as he calls in a medical attendant the obligation to notify passes from the householder to the medical attendant.

It will therefore be seen that the notification is more generally compulsory on both the medical attendant and householder.

The fee paid to the medical attendant (see Table C.) is almost universally half-a-crown for each case notified.

In Newcastle and Dundee it is half-a-crown for private and one shilling for public cases. In Huddersfield it was formerly half-a-crown, but since the year 1880 it has been reduced to one shilling.

The penalties which may be inflicted for non-observance of the Act (see Table C.), vary in amount from forty shillings in seven of the towns, to £5 in six, and £10 in four other towns, while in Birkenhead the penalty is £5 for the first offence, and £10 for the second.

No penalties have been inflicted in ten out of the eighteen towns named(see Table C.). There are six cases in the following five towns in which medical attendants have incurred penalties of the amounts specified, viz. :—Blackburn, 10s. and costs; Bolton, £5 and costs, for not notifying a case of small-pox in a butcher's shop; Huddersfield, one case of 5s., and one of 10s.; Warrington, one case (amount not stated); and in Edinburgh there have been no cases for refusal to notify, but one for not reporting a case of "gastric fever" which the medical attendant thought was not included in the list, the amount of the penalty not being stated.

The following are the penalties which have been inflicted upon householders. At Bradford three cases, amounts nominal; Derby six cases, in four of which it does not state whether on householder or medical attendant; Huddersfield, four cases;

Stafford, two cases in neither of which is it stated whether on medical attendant or householder; and at Warrington, one case.

The penalties inflicted at Boston, Massachusetts, U.S.A., are much more severe, and the regulations much more stringent, than any proposed in this country, as will be seen from the following quotation from Mr. Francis Vacher's Paper on "Sanitation at Boston, U.S.A.":—

"When a disease dangerous to public health breaks out in any town the Board shall immediately provide a hospital or place of reception for the sick, and the Board may cause any sick and infected person to be removed thereto, unless his health would be endangered by such removal, in which case the house or place where he remains shall be considered as a hospital, and persons therein shall be subject to the regulations of the Board.

"The Selectmen and Board of Health shall use all possible care to prevent the spread of infection, and to give public notice of infectious places to travellers by displaying red flags at proper distances, and by all other means which in their judgment shall be most effectual for the common safety. Whoever obstructs the Selectmen, &c., or wilfully removes, defaces, or handles the red flags shall forfeit for each offence not less than 10 nor more than 100 dollars.

"When a householder knows that a person within his family is taken sick of small-pox or any other disease dangerous to the public health, he shall immediately give notice thereof to the Selectmen or Board of Health of the town in which he dwells; if he refuse or neglect he shall forfeit a sum not exceeding 100 dollars. When a physician knows that any person whom he is called to visit is infected with small-pox or any other disease dangerous to the public health, he shall immediately give notice thereof to the Selectmen or Board of Health of the town; and if he refuses or neglects to give such notice, he shall forfeit for each offence a sum not less than 50 nor more than 100 dollars."

There was a slight opposition to the Act in some instances at first (see Table D.), but this appears to have originated from want of knowledge, or undue apprehension of its effect, and in nearly all cases ceased when the Act was fully in operation.

In the majority of the towns, the medical men heartily co-operate to secure the beneficial working of the Act, although their opinion is to a slight extent divided in Blackburn, Bolton, Nottingham, and Preston, and in one town a practitioner opposes the Act, but of this gentleman it is stated that "he is eccentric in many other matters besides the one under consideration."

Before the regulations were in force there were very few

cases notified in any of the towns, and none whatever in most of the large towns. In Bradford, however, nearly all the small-pox cases, and a few others, were notified. In Aberdeen, between the years 1879 and the month of July, 1881, the Act was optional, the fee to the medical attendant being 2s. 6d. for each case reported; and the following numbers of cases were notified under this regulation: 1879, 1,536; 1880, 738; to 31st July, 1881, 836. Since the Act became compulsory, on August 1st, 1881, the following results have been obtained: August 1st to December 31st, 1881, 604; 1882, 3,093; to April, 1883, 466.

The medical officer says:—"It might be asked, Why not remain optional, since so many cases were reported? Well, it was found that it did not act well, for although the majority of practitioners were willing to report, a few who never did, reaped the benefit. The patients quarrelled with their medical men, threatened, and often changed to those whom they learned would not report the case. Now that the reporting is compulsory this source of irritation is allayed."

In Dundee the average number of cases reported before the regulations came in force was 421, and in the four years since then, the average has risen to 1,910.

The medical officer says:—"With regard to Dundee, you may take it as an absolute fact that the system of notification in force has from the first been carried out successfully without the slightest friction or strife between the sanitary authorities on the one hand and the public and medical practitioners on the other. The latter have shown the greatest good sense and good feeling themselves, notifying in every instance, and persuading their patients' friends to do likewise. As to the alleged dangers and harassing vexations attendant on this system of notification, I can only say that here we have had no experience of them. After carefully considering the whole evidence I am of opinion that the dangers have nowhere been proved of serious moment, and the vexations have been unduly magnified."

In Edinburgh, previous to the Act coming into force, not more than fifteen cases per annum were notified; but the numbers obtained since it has been in operation have increased from 386 during the two months, November and December, 1879, to 7,063 in the year 1882.

In Bolton no cases were notified previously, but the numbers recorded since vary from 469 to 1,939 per annum.

In Derby there was no notice of any case prior to the Act coming into force, but the numbers reported since range from 541 to 914 per annum.

In Leicester there were practically none notified before, but the cases recorded since are from 1,343 to 1,841 per annum.

In Norwich there were no cases reported previously, and those now notified have decreased from 853 to 165.

Cases of concealment (see Table D). The medical officers, in twelve out of the eighteen towns mentioned, report that no cases are known.

In Blackburn some cases of scarlet fever were not reported by the medical attendant; but there has been no concealment by any of the householders.

In Derby several supposed cases were reported, all of which, however, on investigation, turned out fallacious. The town clerk says:—"Instead of concealment being engendered by the operation of the Acts, on the part of the public, the contrary has been our experience here, as where it has been attempted the neighbours have always informed the sanitary authority of the case, looking to them for protection from their friends."*

In Huddersfield there have been two cases; in one of which the mother feared removal, and in the other the householder kept back the doctor's certificate and was fined. The medical officer of this town says: "From the freedom with which certificates come in, there cannot be much intentional concealment; practically it is not a difficulty."

In Nottingham the medical officer says: "None; in which I could say that the notification regulations had caused the concealment. *It must be remembered that concealment was very common before notification clauses were thought of.*"

In Staleybridge the medical officer says: "In one case only, said children had measles, to evade reporting it"—measles not being included in the regulations.

In Aberdeen there were some instances of concealment of cases of typhus and scarlet fever, where no doctor had been called in. The medical officer says:—"But as such like cases used to occur before there was compulsory notification, and are no more numerous than then, the regulations have not been the cause."

In Dundee, three alleged cases.

In Edinburgh, the medical officer says: "None; the citizens cheerfully co-operate in carrying out the provisions of the Act. I frequently receive letters from respectable citizens inquiring if cases of infectious disease in their families have been reported by the medical attendant."

In Leicester the town clerk says:—"As to what is urged by the medical profession as to medical men not being called in, it

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* Liverpool Report on Notification of Infectious Diseases, p. 57.

is a theoretical misgiving which, if you are fortunate enough to secure the power, in practice will never be found to arise."*

In Blackpool the mayor says:—"Neither myself nor our medical officer know of a single case of concealment; as the town pays the cost of disinfecting, as well as for all clothing destroyed, where is the object of concealment."†

In Bradford the medical officer of health says:—"As to the allegation that people would conceal infectious disease, and not send for medical advice for fear of having the case reported, I can safely say that such has not been the case in this town. It is true that some cases of scarlet fever were not attended by medical men, but certainly not for the reason alleged. They were mild cases, and were supposed (very erroneously) to require but little care. The parents of three of these cases were prosecuted for not having notified them to the authorities. They pleaded, not that they were afraid of the consequences, but that they were ignorant of the necessity."‡

Reductions have taken place in the zymotic death-rate since the passing of the Act at Bolton, Bradford, Leicester, and Edinburgh (in the last case being very considerable, viz., from 15·31 to 12·18 per 1000). There has been a slight increase at Norwich, owing to an epidemic of scarlet fever in 1880, the year the Act came into force; also a slight increase at Staleybridge, not, however, due to diseases with which the Act is concerned, but caused chiefly by an epidemic of whooping cough.

In a letter from the medical officer of health, Birkenhead, published in the Liverpool Report, he says:—

"The extraordinary allegation that compulsory notification, in places where it exists, has increased the mortality from diseases required to be notified, is certainly not borne out by facts in Birkenhead, as the following figures will show":—

"The mortality from the diseases required to be notified was, during the first quarters of the four years, 1878–79–80–81, respectively 45, 28, 46, 36, giving an average of a little over 38; the mortality from the same diseases during the first quarter of 1882 was 19. The mortality from the diseases required to be notified was, during the second quarters of the four years, 1878–79–80–81, respectively 33, 37, 36, and 34, giving an average of 35; the mortality from the same diseases during the second quarter of 1882 was 16. Thus the mortality from diseases required to be notified has, since compulsory notification came into force in the Borough, so much decreased, that it has been

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* Liverpool Report on Notification of Infectious Diseases, p. 5.
† Ibid., p. 16.
‡ Ibid., p. 20.

less than half the average of the corresponding mortality of recent years."*

The facts from the other towns are not sufficient to form any conclusions.

The unanimous opinion of the medical officers of health is that the regulations have been of great advantage in obtaining earlier information of the existence of cases of infectious diseases, and information as to cases that would not otherwise have been reported. Most of them also state that assistance has been obtained in tracing the origin of outbreaks of infectious disease (see Table E.). The following references to the subject are worth quoting.

From Blackburn the medical officer reports :—"It is next to impossible to compel the cotton mill operatives to thoroughly isolate in infectious cases."

At Bradford the medical officer says :—"The public strongly approve of the Act. Careless people seeing the great importance attached by the authorities to the proper treatment of infection have amended their ways, and take much more care than was formerly the case to prevent the spread of disease."

The medical officer of Chadderton says :—"The compulsory notification is of the very greatest value and ought to be quickly passed for the whole country."

The medical officer of Derby states :—"We should be lost without them. The majority of the Derby people would feel unsafe without their protection, and without the visitation by inspectors to see that proper precautions are taken."

At Norwich, the medical officer says :—"I have been able to obtain valuable information as to the sanitary state of infected localities and to remedy defects, also in many instances to effect isolation."

At Blackpool, the mayor says :—"With its aid we consider ourselves under normal conditions, perfect masters of the situation. Amongst other diseases imported into this town at the begining of this year was a case of smallpox, which our powers enabled us to stamp out at once, and I tremble to think of the ruinous consequences to a town of this character, which might have resulted under the old condition of things."†

From the facts that I have laid before you, I have been forced to the conclusion that "The Compulsory Notification of Infectious Disease" is a very important sanitary measure, and a great boon to the community to whom it has been applied.

There can be no doubt whatever that, in a vast number of

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* Liverpool Report on Notification of Infectious Diseases, p. 34.
† Ibid., p. 15.

cases, information has been obtained of the existence of infectious disease which would never have been obtained at all, or, if obtained, would have come too late to be of much service.

Everyone who has had anything to do with the prevention of Epidemic Diseases, knows that the most important thing of all is to get the earliest information of the cases that arise; and that an epidemic may be checked and stamped out with comparative ease if it is taken in hand early enough, but that the difficulty increases every day that is lost.

The objection that cases of concealment are likely or even certain to occur where such Acts are in force, has been completely met by the quotations that I have made to you; but to my mind, this objection of which so much has been made, is so childish as to be almost ludicrous.

If there are cases of concealment every day where such an Act is in force, there are many times as many such cases where no Act is in force.

One would have thought that it must have been obvious to everyone, that in a town where a hundred cases are reported under the Act, while only ten were reported during the same time, *before* the Act was passed, there are at any rate, ninety cases reported under the Act which *would have been concealed without it.*

With regard to the vexed question as to whether the medical attendant or the householder, or both, should be compelled to notify the existence of cases of these diseases to the sanitary authority, the most general practice appears to be to make it compulsory upon both; but the evidence, as I understand it, shows that at any rate medical men should be required to give the information; and also that they should be required to give it *direct to the sanitary authority*, rather than to the householder.

This is a matter upon which I do not wish to insist strongly, but simply to give the impression that the results of the enquiries have left upon my mind.

I think that the evidence is very strong that in most places, at any rate, little or no difficulty has arisen from the medical men being compelled to give this information. As to the suggestion that these Acts, so far from diminishing the number of cases of infectious diseases, are likely to increase them, I would ask you do you think it likely that, without any exception, the medical officers of health of the towns where these Acts are in force, would support them strongly if *they* thought the number of cases of infectious diseases was going to be increased by them?

The business of the medical officer of health is to *prevent*

disease—especially such diseases as these—and he gains credit by doing this, and *not* by *increasing* them.

Do you suppose that these medical officers of health do not know their own business, or do you suppose that they have combined together to do that which must certainly bring discredit upon themselves?

I ask you on the contrary to believe that the medical officers of health of these towns know the way to prevent infectious diseases from spreading, and are doing their utmost to lead the medical profession and the public generally, up to the point of seeing the great need for the passing for the whole kingdom of such an Act as those which have been so beneficial where they have been applied. And I take this opportunity of thanking all those gentlemen for the trouble they have taken in answering the questions sent to them, and so enabling us to epitomise the evidence on the subject.

TABLE A.

Population and Date of E

Name of Town.	Population. 1871.	Population. 1881.	Dat re can	Years	Months
Birkenhead	65,971	84,006	Jan., 1882	1	3
Blackburn		104,064		3 or 4	
Bolton	82,853	105,414	Sept., 1877	5	6
Bradford	147,101	183,008	July, 1881	1	9
Chadderton	12,205	16,897	Aug., 1882		7
Derby	49,810?	81,171	Nov., 1879	3	5
Huddersfield	70,252	81,825	{Autm. 1876§}	6	6
			{ „ 1880 }	2	6
Leicester	95,220	122,376	Sept., 1879	2	6
Newcastle		145,228	Sept., 1882		6
Norwich	80,386	87,843	1880	2	6
Nottingham	86,000	186,000	Apr., 1882	1	
Preston	85,427	96,524	Oct., 1880	2	6
Stafford	15,437	19,977	1880	2	6
Staleybridge	21,092	22,784	Aug., 1881	1	7
Warrington	32,144	41,482	July, 1879	3	9
Aberdeen	88,181	105,076	Aug., 1881	1	6
Dundee	120,724	142,454	Dec., 1878	4	4
Edinburgh	196,979	228,346	Nov., 1879	3	5

TABLE B.

cluded in the Regulations.

											Puerperal Fever.	Erysipelas.	Total.
Birkenhead	1										...	...	9
Blackburn	1										...	...	5
Bolton	1										1	...	8
Bradford	1										...	...	6
Chadderton	1										1	...	9
Derby	1										1	...	8
Huddersfield	1										1	...	†8
Leicester	1										1	1	8
Newcastle	1										1	...	9
Norwich	1										...	...	7
Nottingham	1										...	...	‡2
Preston	1										1	1	9
Stafford	1										1	...	8
Staleybridge	1										1	...	7
Warrington	1										1	...	8
Aberdeen	1										...	...	6
Dundee	1										1	...	§9
Edinburgh	1	*	*	*	...	*	...	*	...	*	...	...	7
Total	18	4	18	17	2	17	10	17	4	15	11	2	135

* These were included at first, but not afterwards. † With powers to add. ‡ These two only during period of trial. § And such other diseases as the Commission may declare to be infectious. ‖ The Regulations during this period were apparently so imperfect that they have not been included in Tables B. D. & E.

TABLE C. Persons who are to notify. Fees, Penalties, and Inflictions.					TABLE D. Opposition to Regulations and Concealment of Cases of Infectious Diseases.		TABLE E. Advantages of Regulations, and general opinion of the Medical Officer of Health on their working.			
							Advantages.			
TOWN.	Notification to be given by	Fees.	Penalties.	Inflictions.	Opposition.	Concealment of Cases in consequence of regulations.	Earlier information of the existence of cases of I. D.	Information as to cases that would not have been reported.	Assisted in tracing the origin of outbreaks of I. D.	General opinion of M. O. H.
Birkenhead	M.‡	2/6 to M.	£5 1st. £10 2nd	None.	Yes, at first by M., but now ceased.	None known.	Yes.	Yes.	Yes.	Have certainly assisted the Sanitary Authority.
Blackburn	M.	2/6, with interval.	£5.	One on M., 10/- & costs.	Yes, by three or four M.	Some not reported by M.	Yes, generally.	Yes.	*No*, except in spid. of S. P.	*Not much actual* benefit, except in S. P.
Bolton	M. & H.	2/6 to M.	£10.	One on M. £5 & costs.	Yes, by a small proportion of M.	None known.	Yes.	Certainly.	Yes.	Satisfactory, freedom from I. D greater; death-rate reduced.
Bradford	M. & H.*	2/6 to M.	£5.	Three on H., nominal.	Not to notification, but to further powers.	None known.	Decidedly.	Certainly.	Yes.	Satisfactory.
Chadderton	M. & H.	2/6 to M.	40/-	None.	None; notification voluntary before Act.	None known.	Yes.	Yes.	Yes.	Results of the greatest value.
Derby	M. & H.	2/6 to M.	40/-	Six †	Yes, by one M.	None.	Decidedly.	Certainly.	Yes.	There can be no doubt of their utility.
Huddersfield. ...	M. & H.	First 2/6, & then 1/ to M	£5.	Two] on M. & four] o	[&	but Two†	Yes.	Yes.	Yes.	*Useless unless* energetically carried out.
Leicester	M. & H.	2/6 to M.	£10.	None.		but None known	Yes.	Yes.	Yes, very much.	Very satisfactory.
Newcastle.....	M. & H.	Private 2/6 Public 1/- to M.	40/-	None.	not after passing. Opposition before not after passing.	but None known.	Yes.	Yes.	Yes.	Of much advantage, but
Norwich	M.	2/6 to M.	£5.	None.	None.	None known.	Yes.		Yes.	Enabled me to obtain valuable information.
Nottingham	H.†	2/6 to M.	£5.	None.	Yes.	Not more than before the regulations	Yes.	Most certainly.	Yes, very decidedly.	The results are proved to be beyond doubt of great benefit to the public.
Preston	M.‡	2/6, with interval.	£10.	None.	Yes, by a few M.	None known.	Most certainly.	Most certainly.	Most certainly.	Of great service in checking the spread of infection
Stafford.....	M. & H.	2/6 to M.	£5.	Two.	Very little.	None known.	Certainly.	Certainly.	Most decidedly.	Most satisfactory.
Staleybridge	M. & H.	2/6 to M.	40/-	None.	Very little.	One.	Yes, most certainly.	Yes.	No.	I believe great good in the end will come.
Warrington	M & H.	2/6 to M.	£10.	One on M., one on H.	Very little since passing	None known.	Certainly.	Certainly.	Certainly.	
Aberdeen	M. alone	2/6 to M.	40/-	None.	None.	Not more than before the regulations.	Most undoubtedly	Yes.	Yes.	Complete control over all the diseases.
Dundee	M. & H.	Pri. 2/6 to M. Pub. 1/- to M.	40/	None.	None.	Three.	Undoubtdly	Certainly.	Yes.	Of the greatest benefit to the Public Health.
Edinburgh	M. alone	2/6 to M.	40/-	One on M. for omitting a disease included in the list.	Opposition before but not after passing.	None known.	I have no doubt on the subject.		Yes	Of great advantage in several ways.

M. = Medical Attendant. H. = Householder * But the M. need only give Certificate to H. † But the M. is to give Certificate to H. ‡ Or on H if there is no M.
‖ One of these on M., and one on H., were under the first Regulations.

J. H. COFFIELD.

CONGRESSES AND OFFICERS.

TABLE showing the places at which the Congresses of the Sanitary Institute of Great Britain have been held; with Presidents, Presidents of Sections, and Honorary Local Secretaries and Treasurers.

Presidents.	Presidents of Sections.	Honorary Local Secretaries & Treasurers.
1877. B. W. RICHARDSON, M.D., LL.D., F.R.S., Leamington, October.	EDWIN CHADWICK, C.B. GEORGE WILSON, M.A., M.D., F.C.S. BRUDENELL CARTER, F.R.C.S.	J. THOMPSON, M.D. JOSEPH S. BALY, F.C.S. T. H. THORNE, J.P.
1878.—EDWIN CHADWICK, C.B., Stafford, October.	B. W. RICHARDSON, M.D., LL.D., F.R.S. HENRY DAY, M.D., F.R.C.S.	W. ELLIS CLENDINNEN. H. B. LIVINGSTON. THOMAS WOOD.
1879—B. W. RICHARDSON, M.D., LL.D., F.R.S., Croydon, October.	ALFRED CARPENTER, M.D., M.R.C.P.LOND., C.S.S. CAMB. CAPTAIN DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S. G. J. SYMONS, F.R.S.	H. J. STRONG, M.D. ROBERT HALL. SAMUEL LEE RYMER.
1880.—The Right Hon. EARL FORTESCUE, Exeter, September.	PROF. DE CHAUMONT, M.D., F.R.S. R. RAWLINSON, C.E., C.B. SIR ANTONIO BRADY.	E. J. DOMVILLE, M.R.C.S.E. H. P. BOULNOIS, M.INST.C.E. W. G. ROGERS.
1882.—CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S., Newcastle-upon-Tyne, September.	DENNIS EMBLETON, M.D., F.R.C.S. H. LAW, M.INST.C.E. ARTHUR MITCHELL, M.A., M.D., LL.D., F.R.S.	W. G. ARMSTRONG, M.R.C.S. J. H. AMOS.
1883.—Prof. G. M. HUMPHRY, M.D., F.R.S., Glasgow, September.	PROF. W. T. GAIRDNER, M.D., LL.D. PROF. T. ROGER SMITH, F.R.I.B.A. R. ANGUS SMITH, PH.D., F.C.S.	J. B. RUSSELL, M.D. JAMES SELLARS, I.A. HENRY JOHNSTON.

The next Congress of the Institute will be held at Dublin, September 30th to October 4th, 1884.

CONGRESS AT GLASGOW.

SEPTEMBER, 1883.

PAPERS AND DISCUSSIONS.

INTRODUCTION.

By invitation from the Lord Provost and Town Council, seconded by an influential representative meeting in the City, the Sixth Congress of the Institute was held at Glasgow, from September 25th to 29th, 1883. The various meetings and lectures in connection with the Congress were held in the St. Andrew's Halls, in Granville Street, the accommodation in the building being well suited for the purposes, and the reception room and offices were also provided in the same building.

The papers submitted to the Congress were divided as usual in three Sections.

Professor G. M. Humphry, M.D., F.R.S., delivered the Inaugural Address on Tuesday evening, Captain Douglas Galton, R.E., C.B., F.R.S., President of the last Congress, taking the Chair, and formally installing Professor Humphry as Chairman of the Congress at Glasgow.

Dr. B. W. Richardson, F.R.S., delivered the lecture to the Congress on Thursday evening, and Dr. Alfred Carpenter delivered an Address to a very large audience of the working classes on Saturday evening.

The papers read at the Congress were divided into the following Sections:—

Section I.—Sanitary Science and Preventive Medicine, presided over by Professor W. T. Gairdner, M.D., LL.D. Section II.—Engineering and Architecture, presided over by Professor T. Roger Smith, F.R.I.B.A. Section III.—Chemistry, Meteorology, and Geology, presided over by R. Angus Smith, PH.D., F.R.S. One day was devoted to each of these Sectional Meetings, thus occupying Wednesday, Thursday and Friday.

A Public Luncheon was held on Tuesday afternoon, at which the Lord Provost presided, and welcomed the Institute in the name of the Town.

On Wednesday evening a Conversazione was given by the Town Council, and was very largely attended.

A Public Dinner was held on Friday evening at the close of the Business Meetings of the Congress.

An Excursion down the Clyde and round the Kyles of Bute was arranged by the Local Committee for the Saturday.

Very suitable buildings for the Exhibition, which was open from September 25th to October 20th, were provided in the Burnbank Drill Hall, Great Western Road.

There were 130 exhibitors and 720 exhibits. The Judges awarded 18 Medals, 12 Special Certificates (to articles which had received Medals at previous Exhibitions of the Institute), and 46 Certificates. Forty-four exhibits were deferred for further practical trial and testing, and the result of these trials will be reported at the Anniversary Meeting in July, when all the Medals and Certificates will be presented. About 20,000 people visited the Exhibition during the twenty-six days that it was open.

Owing to some local difficulties Cheltenham is unable to receive the Institute in 1884, as previously arranged; the Council, therefore, accepted a very largely-supported invitation from the leading societies and from the prominent and influential residents in Dublin to hold the Congress in that city.

E. WHITE WALLIS,
Secretary.

April, 1884.

Officers of the Glasgow Congress.

President.

PROFESSOR G. M. HUMPHRY, M.D., F.R.S.

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The Earl of Glasgow.
The Earl of Rosebery.
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John Burns.
Rev. G. S. Burns, D.D.
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F. W. Clark (Sheriff of Lanarkshire.)
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Sir Edward Colebrooke, Bart., M.P. (Lord Lieutenant of Lanarkshire.)
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Colin D. Donald (Dean of the Faculty of Procurators, Glasgow.)
Principal Douglas, D.D
Sir J. Whitaker Ellis, Bart.
H. E. Crum Ewing (Lord Lieutenant of Dumbartonshire.)
Archibald Orr Ewing, M.P.
Archbishop Eyre.
Leonard Gow.
Thomas Henderson.
John McLaren (President of the Chamber of Commerce, Glasgow.)
Professor McKendrick, M.D.
Robert Scott Orr, M.D. (President of the Faculty of Physicians and Surgeons, Glasgow.)
William Pearce.
Right Hon. Sir Lyon Playfair, C.B., M.P., F.R.S.
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Lord Dean of Guild Stephen.
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Professor James Thomson, LL.D.
Sir James Watson.
Dr. William Wallace, F.R.S.E. (President of the Philosophical Society, Glasgow.)
James White, Overtown.
Thomas Wright, M.D., F.R.S.

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THE HON. THE LORD PROVOST OF GLASGOW, *Chairman.*

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" " Easter Pollokshields.
The Provost, Govan.
" " Govanhill.
" " Hillhead.
" " Kinning Park.
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James Thomson, President of the Institute of Architects, F.R.I.B.A., 157, St. Vincent Street, Glasgow.
Prof. James Thomson, LL.D., The College, Glasgow.
Andrew Wallace (President of the Sanitary Association of Scotland), 7, Carlton Place, Glasgow.
Dr. William Wallace, F.R.S.E., 138, Bath Street, Glasgow.
Dr. James Wallace, M.O.H., Greenock.
Thomas Wharrie, C.E. (Burgh Surveyor), Hillhead.
Alexander Wylie, Cordale, Dumbartonshire.

Honorary Local Committee.

J. B. Russell, M.D. | James Sellars, I.A. | Henry Johnston.

Officers of the Sections.

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President.

PROFESSOR W. T. GAIRDNER, M.D., LL.D.

Vice-Presidents.

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INAUGURAL ADDRESS

By Professor G. M. Humphry, M.D., F.R.S.,

PRESIDENT OF THE CONGRESS.

Our presence here this evening, by invitation from the Lord Provost and Town Council of Glasgow, for which I beg leave to return hearty thanks on behalf of the Institute, is an evidence that the importance of the work in which we are engaged is recognised in this great focus of commercial and engineering activity, and may, I hope, also be regarded as an indication that the manner in which we do our work is regarded as satisfactory.

The importance of the work can scarcely be over-estimated; and, without fear of acquiring the attribute of egotistical assumption, we may safely assert that of all the many Congresses taking place at this time of year there is none in which the subject matter is of more vital interest to the community than that of the Sanitary Institute. This indeed might be stated if our work could be regarded as ministering to the improvement of the physical condition only of man with all the greater amount of comfort and happiness attendant thereon. But when we bear in mind the close connection between the mental, the moral, and the physical, and reflect that the mental and the moral qualities are to a large extent the outcome of the physical, and vary with it, and that therefore a deterioration or an improvement of it are necessarily associated with a deterioration or an improvement of them, then the value of sanitary work assumes vastly greater proportion and we learn more fully to appreciate the feeling which, even in long past ages, esteemed the laws that relate to the sanitary condition of a people as supreme.

So close indeed, further, is the interdependence of the physical, the mental, and the moral in man that an improvement or a deterioration in any one is certain to be attended by an

improvement or a deterioration in the other two. If, from indifferent sanitary arrangements or other cause, the physical be allowed to sink, the mental and the moral forces, which as just stated are dependent upon it, must soon be weakened. So also good sound education and that mental training which gives strength to thought and judgment, and which can only be carried out in the healthful body, will react beneficially upon the body as well as upon the moral tone, and will add to that uprightness and honour and that vigorous bearing which make the man. Still more true is it that moral delinquency ravages both body and mind, throws its dark shadow over coming generations, and infallibly leads to the degradation of the species. It does this, mainly, by its direct and indirect influence upon the body, by the infecting stain there which, like that upon the character, lurks and leavens the whole and bears on the father's sin to distant generations—"out, damned spot! out, I say." "Who would have thought the old man to have so much blood in him." "All the perfumes of Arabia will not sweeten this little hand. Oh! oh! oh!" Now what is so important, and what we want our legislators to feel, especially at the present particular juncture, is this, that in proportion as this stain is allowed to exist and to propagate itself and, by its hydra-headed maladies, to damage the bodies and lower the physical status of the people, so much the greater will be the deterioration of character and the tendency to moral obliquities of various kinds. This is one, and a potent one, among the ways in which vice sows the seed of future noxious weeds and fertilizes the soil for their growth. The moral delinquencies damage the body; and the so damaged body is the more prone to the moral delinquencies. The action and reaction is direct and swift. One way, therefore, to limit and arrest moral disease and to increase the healthy moral tone of a community is to limit and arrest bodily disease and to labour in every possible manner to improve the sanitary condition of the body. No sentimental fancies, no overdrawn apprehensions of interference with the liberties and rights and free action of citizens should be allowed to hinder the enforcement of those principles and laws which are requisite for the prevention and mitigation of disease, whether they be in the form of factory acts, of educational codes, of contagious diseases acts, or of provisions for the careful and humane conduct of experimentation upon animals. Let the *salus populi*, simply and sensibly and at the same time scientifically considered, be really and practically the *suprema lex*. Thus shall we best promote strength of mind, with attendant wise judgment and discretion, as well as sound morality, with attendant high-mindness and honourable feeling, in our people.

How largely does experience show us that the body is not merely the inlet to the mental and the moral chambers and the agent of the forces emanating thence, but that it is also, and to some extent consequentially, the type of them? How much, that is to say, of them can be inferred from it? What do we not learn of the largeness and strength and vigour of them from the corresponding evidences in it? How rarely is a strong and vigorous mind associated with a feeble and inert body? What kind of character do we judge to be the accompaniment of the upright frame, the open face, and the straightforward step? I admit that there are many exceptions. It must be that the complex machinery that makes up the mental, the moral, and the physical fabric of man is liable to many variations which warn us against too hasty judgment in individual cases. But let the many exceptions *probe* or try, not as often wrongly said *prove*, the rule. Perhaps nowhere is the rule more markedly evinced than in this northern part of our Island in which we now find ourselves. My remarks, let it be observed, have relation to peoples; and I always feel, what I think is by many admitted, that the Scotch are the finest people on the earth's surface, that the grandest combination of the physical, the mental, and the moral is produced here, the sturdiest, halest bodies with the largest brains, the strongest minds and the best morale—the qualities best calculated to thrive in every quarter of the globe. I always maintain that the quality, and it is a good one, of the English breed is not a little due to the flow of northern blood which, happily in a steady stream, is drawn southward by our somewhat more genial clime and by the other attractions associated with it. Long may Scotland thus prove England's best friend by being a prolific father and a nursing mother of her people and by contributing its annual quota towards the maintenance of her stalwart, upright, talented race.

By this providential, or natural, law of the association of the physical with the other qualities is worked out the predominance of the best. In the great struggles of nations the best win because goodness is the associate of strength and healthfulness; and the maintenance of the sanitary condition of a people is a necessity to the maintenance of a high position among others. This becomes yearly more and more the case as increasing civilization makes us increasingly dependent upon sanitary regulations and determines more clearly what those regulations should be. It is thus that civilization meets and counteracts her own evils. The clustering of peoples in masses together promotes, in various ways, the liability to disease, while growing intelligence and advancing science point out the means of preventing and arresting it; and as prevention is better than cure, so the

science which promotes the former is better than that which attempts the latter. To this the members of my profession are fully alive and willingly assent; and though their pecuniary gains are won by their efforts to cure disease, it is their constant and unselfish aim to trace out and stamp out the sources of disease; and it is their desire and practice to take an active part in every movement which has for its object the improvement of the sanitary condition of our people. Well will it be for our country when increased opportunity is given to them, in Parliament and out of Parliament, of making a deeper impression on the convictions of the country. One result, that we might anticipate from such an influence, would ere long be the institution of a Sanitary Department in our legislature, distinct from the Local Government Board, and under the direction of a Minister of Sanitary affairs, and I can scarcely conceive anything more likely than this to promote the well-being of our people and their success in everything they undertake whether it be literary, scientific, commercial or military. Such an office extending its administration to the sanitary condition of cattle would do much to reinstate the interests of agriculture, and to reduce the price and improve the quality of animal food; and it would find a further scope for action in considering and checking the diseases to which our various food-producing plants become more liable as they are more highly cultivated; and which, in many parts of the globe, are producing great devastation and pecuniary loss with accompanying distress and injury to the peoples. Under such a Sanitary office the department of the Registrar-General would properly be placed; the Ordnance and Geological Surveys and the Meteorological Office should be in connection with it; and this Institute would be a valuable handmaid in carrying on that which is perhaps its most important work, the conducting the examination of Surveyors and Inspectors. The greater extension of this work is sorely needed. A certain amount of suitable education, tested by examination, should be required of all candidates for these responsible offices; and it is obvious that a satisfactory fulfilment of the duties of surveyors and inspectors, and a respect for their opinions cannot be expected unless there is some security for the possession by them of a knowledge of the elements of sanitary science. The University of Cambridge has undertaken, and for some years carried on, an examination of medical men for certificates in sanitary science. Such certificates should be a necessary qualification for medical officers of health; and a subject of so great scientific interest, demanding so wide a range of knowledge, and fraught with such far-reaching benefits to mankind, ought certainly to be

included in the area of University teaching. The funds at the disposal of the University of Cambridge are not at present sufficient to accomplish this, or likely to be so for some time; and I do not know that a wiser and more beneficent direction could be given to the liberal aspirations of those who are indebted for ample means to the bone and sinew of the people than the foundation of a Professorship of Sanitary Science in the University, so giving the subject a definite place in the studies at that ancient seat of learning.

Among other benefits which would be likely to follow the formation of a separate governmental department, giving its full and undivided attention to sanitary matters, is the re-distribution and greater equalisation of the sanitary districts, together with a provision for their harmonious co-operation—the bringing, that is, of all into closer relation with one another and with the central department, so that the events which are taking place in one district might be speedily communicated, telegraphed if necessary, to others, and timely preventive measures against the spread, or transmission, of disease be taken.

Moreover, the higher and more definite relation with the Government of a separate sanitary department would tend to promote that official sympathy which is now much wanting, and would encourage a proper attention to, and recognition of, the services of those men who devote their time and abilities to sanitary science. It also would lead to a due consideration by Parliament of the pressing sanitary needs of the people: matters of far more importance to the nation than "agricultural holdings," "criminal procedures," and the greater number of those subjects upon which so much of the preceding sessions have been spent.

Good sanitary legislation must ere long be recognised as one of the first necessities for a prosperous people; and the Government of England ought not to lag behind, as it has a tendency to do, in its efforts to provide this great boon for the nation. It should take more active cognisance of the fact that a people must be preserved from the effects of their own imprudence; and it should not leave the carrying out of hygienic works, so much as it does, to parochial administrations and local authorities. It should be borne in mind that to be great a people must be healthy and vigorous, and that one of the causes to which the fall of the Roman empire has been attributed is "the pestilences which swept off the adult male population, and left the then proud mistress of the world an easy prey to the barbarians."*

The Government of the United States has shown its con-

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* *Essays, "Public Health,"* p. 5.

sciousness of responsibility to take action in this direction by a resolution of Congress, introduced at the suggestion of the National Board of Health, requesting the President to call an International Sanitary Conference, with a view to consider and improve the condition of the ports under the jurisdiction of the several Powers, as well as of the vessels departing from them. That Congress was well attended by delegates from Europe and other parts; several questions were seriously and carefully discussed, and important propositions were made. What is perhaps even more to the point, each one of the United States, with few exceptions, has its "State Entomologist;" and they all publish full annual reports upon the damage done to food-plants by various insects, and suggest means of prevention. Why should not something of that sort be done here? In most of the European States there is some recognition of duty in this respect; and much has been done in England through the Board of Health, the Local Government Board, and various legislative enactments. Still there is ample room for England to concentrate and improve her national sanitary organisation in such a manner that it may be an example to others.

Above all, in the case of the Army, and also of the Navy, it is a most urgent need that the sanitary service should be rendered more efficient, and placed upon a definite footing as a separate part of the medical staff, so that it has its distinct training, duties, responsibilities and powers. This cannot be too strongly impressed upon the authorities at the War Office and the Admiralty. It is not too much to say that next in importance to good generalship, for the success of a campaign, is good sanitary arrangement. Of what use are the best soldiers unless they are well handled and kept in good health. The prevalence of disease brings not only fatality but dispiriting and disorganisation. The massing together of troops in any place is certain, after a short time, to be productive of disease, unless the precautions taken against it are most careful and most rigid; and sad experience tells that the ranks of a stationary army are liable to be quickly decimated. To this are to be added the contingencies of climate, exposure, sudden variations in marches and in food, and the many liabilities of a soldier's life, to say nothing of the inflictions of a soldier's dress and accoutrements. Still, it ought not to be said that in our provisions against these sources of malady we are inferior to the Roman generals and the great captain of the Macedonian army, who owed their successes, not a little, to the endeavours they made to keep their soldiers in good health; and the records indicating an amount of unhealthiness in the British armies, exceeding that of the French and some others, ought to stimulate to some change in our arrangements. It has been computed

that in ordinary warfare the victims of disease are three times as many as those of the sword, with which, I take it, are included the fearful adjuncts to that weapon made by modern science. This startling announcement ought surely to arouse the attention and stimulate the efforts of the authorities. Yet it appears that little advance has been made since the disastrous period of the Crimea. It is appalling to contemplate what would probably have been the consequences of a prolonged campaign in Egypt. The one thing we have to regret in the easy victory of Tel-el-Kebir, with the consequent quick termination of hostilities, is the prolongation of indifference as to sanitary precautions, and the postponement of the lesson we should there have had, till, possibly, some severer penalty compels a reform. Why should we wait for disaster to enforce the dictates of reason and common sense? The insufficiency of the provisions for the medical-staff in Egypt, of which we heard so much—I do not mean of the medical-staff itself, but of the provisions for its operations—are bad enough; but the want of a thorough sanitary organisation, under the direction of well instructed and able men, is a far graver source of danger. Upon the lowest ground, as a mere matter of economy, this subject demands serious and urgent attention. The brave British soldier and sailor, bound and willing to face the battle and the breeze, are costly as well as valuable articles, and ought not to be at the risk of exposures to sources of disease, which science and wisdom would have foreseen and provided against. Squander money on big guns and other destructives of the foe, if you please, but grudge not the means requisite for the preservation of the men on whom you rely to fight your cause. What is more sad than to see our fine soldiers quit our shores, and feel that there is no adequate provision against their pining and wasting on a foreign soil without perhaps ever having the opportunity of seeking reputation at the cannon's mouth?

Under the most favourable circumstances, and in spite of the good influence of drill and discipline upon the physical and mental qualities of the men, a standing army is, to some extent, necessarily a deteriorator of national physique, inasmuch as by the selecting influence of recruiting regulations the best specimens are withdrawn from the community just when they are entering upon the vigorous period of manhood; and they are subjected to a high rate of mortality, from the peculiarities of their barrack-life, as well from exposures of various kinds to which I have alluded. The augmentation of an army, therefore, directly debilitates a nation and lessens its fighting power by the drain it makes upon the best bone and blood of the land. This is fully as serious, as the drain which it

makes upon gold, even if we take into account the diminution of gold-producing power consequent on the abstraction from the labour market of so many men in the prime of life; and it is less easily repaired. Every effort, therefore, should be made to reduce the drain to the minimum by the adoption of those precautions which sanitary science and experience show to be most calculated to prolong life and give health to the soldier.

Let our Institute play its part in upholding the British name by not resting till proper measures have been taken to render the sanitary staff a more organised, efficient, independent, and potent factor in the British army and navy—one which may exert its influence in peace as well as in war, in our foreign stations as well as at home, and which may make itself acquainted, as far as possible, with the sanitary conditions of various parts of the world in regard to military occupation.

The honourable and responsible task of presiding in this Congress and addressing you this evening has been assigned to me, I conceive, because the greater part of my life has been spent in the active duties of the medical profession and, therefore, necessarily, in an observation of the causes which lead to disease and early death, as well as of those which prevent the full development of the human body. On that ground alone can I venture to take my stand in addressing you. I cannot think of vying with our former Presidents who have devoted so much attention and ability to sanitary science—with Dr. Richardson, Lord Fortescue, and Captain Galton, and with him who, after fifty years of continuous labour in this direction, may pass on into his rest with the comforting assurance that he has saved more lives and done more to promote the physical and moral welfare of his countrymen than any man of our generation. I need scarcely say that I mean Edwin Chadwick. The exhaustive and admirable address given at Newcastle by the learned officer in whose steps I am called upon to tread, may well suffice for a couple of years. I have neither the time nor the ability for such a work; and I trust you will allow the mantle of its excellence to cover the deficiencies of this more humble effort.

The brief remaining time at our disposal will probably be turned to best account if I content myself by dwelling upon some of those points and thoughts which professional experience has impressed upon me; and I will take, first, and chiefly, those which relate to early life, forasmuch as they are the most important.

Small matters have often great import, especially at the

beginning of life; and this may be truly said of those mischievous two yards of calico or flannel which, wound round the middle of so many infants on their introduction into the world, as a sort of baptism to the numerous evils of fashion in dress to which they are admitted, constrict and hinder the expansion of that very region of the body where heart and lungs, stomach and liver, organs of no mean importance, are struggling for room to grow and do their work, and where natural mechanical conditions throw some difficulty in the way of full development. The expansion of the lower part of the chest, which is so pronounced a feature in the well-formed human figure, is attained chiefly in the higher animals, and, like most of such higher prerogatives, is the result of more than ordinary effort, and is, proportionately, liable to suffer from interference. The chief effort to accomplish it is made, soon after birth, when breathing and food-taking, and the various changes incidental upon them begin; and at this very juncture the opportunity is taken by meddlesome hands to hinder the expansion of the region where these new processes, upon which the well-being of the whole fabric depends, have to be initiated and carried out. A more pernicious device can scarcely be conceived than this relic of antiquated nursedom; and it is impossible to estimate the number of deformed, or pigeon-chests, of hampered stomachs, livers, lungs, and hearts, with their varied attendant life-enduring infirmities, and curtailment of life, that must result from the use of these "swathers," as they are called, for which there is not the slightest necessity. The oft-condemned tight waist-banding, and lacing of after years, which affects only the small fashionable section of one-half of the community, is not, even in those who are subjected to it, so mischievous as this concealed semi-strangling process which is diligently carried out in the case of a large proportion of infants of all classes. Of the three demands of the infantile period—liberty of movement, fresh air, and good food—it seems strange that the first two should be limited by smothering bed-clothes, swathers, long petticoats, and other dress-devices, together with imperfect ventilation of rooms, while the last is liable to be supplied sometimes in insufficient quantity and bad quality, but often, whether good or bad, in superabundance. How many poor helpless children are condemned into spasms, diarrhœa, convulsions, and death, which are complacently attributed to teething, that never failing cover for the multitude of the sins of the feeder. No other infant has, altogether, so bad a time of it as the human. None pays such penalties to the caprices, the fancies, the theories, and, above all, the immoralities of its parents.

A host of maladies, with a corresponding death-rate, are ignorantly regarded as its rightful heritage; and, as a sort of excuse for this many headed monster in the form of maltreatment, it is urged that, after all, the effect is that the weak are weeded out while the stronger survive, so as to result in the production of a healthier average manhood, and the maintainance of a finer stock. It is said that if, by better sanitary arrangements, we keep alive the weaker members, the effect will be that the physical status of the whole family will be lowered. A little consideration will, however, show that this is not only an inhuman but also a partial view; and we shall find here no exception to the rule that that which is most right is most politic. The same better methods which preserve some in life who would otherwise have passed out of it give better condition to all those who survive. All are, as it were, raised a step on the physical ladder, and the status of the whole is improved.

The mention of one part of the human frame which labours under developmental difficulties, and which is sorely hindered by impediments, reminds of another part which is even worse circumstanced. The well-formed human foot may be regarded as nature's last and hardest, and not least beautiful, work. It is the most characteristic feature of the human body, that to which man owes his erectness and firmness of gait and his ability to use the hand as the minister of his will. Even under favourable circumstances it attains perfection only in the higher groups of the human family; and in them it fails to do so more often than any other part of the body. The compact well-formed arch, the slightly spreading and gracefully curving supple toes, which give firmness together with spring and elasticity to the step, are comparatively rarely attained; and what atrocious impediments are thrown in the way of their acquiring and maintaining their proper form! The foot confers, as I have said, much upon the hand, and ill deserves the return made to it. How pretty is the infant foot, graceful in outline, supple, free, and varied in its movements. It has the hard task before it of being the unaided weight-bearer and propeller of the body reared erect and at right angles upon it; a task which it alone in the animal world attempts, and for which an exquisite mechanism is required and provided. Accordingly, it is forthwith hindered in its proper growth, crippled, deformed, stunted and weakened by bad-fitting unyielding cases constructed with an ill-advised view to economy or in accordance with a bad and meretricious taste. Never has this been more exemplified than in the odious combination of high heel and compressed pointed toe which transforms beauty to ugliness, curtails the play of the foot, shortens the step and spoils the

gait. We regard the Chinese foot as the *ne plus ultra* of barbarism in fashion, and we think of it with wonder and horror. But, be it remembered, that foot is not intended to do work. It is unfitted for duty and it is relieved from it. The Chinese lady is not to be subjected, like common folk, to the undignified trouble of walking about; and her feet are therefore superfluous. The Chinese must regard our fashion as even more absurd which cramps the feet and yet expects them to do their work, which takes away the straw and yet requires the tale of bricks. Still fashion will have its sway, and will bring its penalties in flat feet, crooked toes, and corns; and these, besides the direct suffering and trouble they induce, by interfering with natural exercise and movement, weaken the whole body, and lead to a variety of secondary ailments. Indeed, swathers and tight shoes may well be regarded as among the insidious and fertile sources of disease, and therefore worthy of the consideration of a Sanitary Congress.

Peculiarly is it the case in this island with regard to the foot. For if I mistake not, our countrymen, well cared for by nature in this respect, are, with regard to it, the greatest offenders against nature; and these offences in the matter of the foot are among the most prejudicial of their kind. The tattooings and the nose and lip-borings of various Indian tribes, and the head-flattening of others, which we stigmatise as barbarous, are not so damaging as the foot-spoiling so common among ourselves, and especially among our agricultural poor. The straight firm great toe, the high plantar arch, the well developed calf—three specialities of man, without which he cannot walk and run as he ought to do —are too commonly made, during childhood, to degenerate into the obliquely slanting toe, the flat foot and the puny calf, and the hobbling hesitating gait is substituted for the firm bold step. We must proportionately suffer in the race of life, and shall infallibly find out the disadvantage to our cost, whenever we come to be matched in the military march against a better shod and therefore better footed people.

To pass on to another subject which greatly concerns the well-being of the young, and therefore of the whole community, and which does so more especially at the present time, when it is being extended to the masses of our population, viz, Education. Will this extension advance the sanitary and moral condition of the people and therefore prove a boon to them, or will it not? This is a serious question; and the answer to it depends upon the quality and quantity of the education given. Education which strengthens as well as informs the mind, which increases the powers of reasoning as well as provides the material upon which to reason, will, we may be certain, improve

the physical as well as give tone to the moral qualities of man. All experience proves this. Knowledge, con-joined with the power to wield it, brings all nature under our sway. It not only reveals to us the best paths to health and strength of mind and body, but it also enables us to follow them. Sanitarians are therefore necessarily educationists; and their work is to ascertain and point out the kind of education which will be thus improving, to show that all which passes under the name of education does not deserve the name, that much, indeed, which is so called is calculated to produce the very opposite effects to those which are intended, being likely to lower instead of elevate the mental and moral standard. This it assuredly will do if it is so conducted or so pressed, as in any degree to weaken or damage the physical status.

It is for us to point out and strongly impress upon those who are engaged in education, that that education, and that only, is good which stores the mind without injuring the body. We cannot too often, or too forcibly, reiterate the statement that the mental and moral qualities are largely dependent upon the physical, and will rise or fall with it, and especially in these days, when, in the growing struggle for existence, teachers are being ranged against teachers, and pupils against pupils, in competition for certificates, prizes, and places. The temptation to over-strain, and be over-strained, is great; and the ill results upon mind and body are becoming more and more apparent. Every mental effort is attended by brain-wear. The greater and more prolonged the effort the greater the wear; and, unless sufficient time be allowed for repair, exhaustion ensues, and the brain is rendered less capable of renewed effort. Let it be remembered, especially, that this is true of attention. The teacher is apt to think attention an easy matter, and to punish quickly for inattention, whereas in reality it is almost the whole matter. It is the concentration of the mental batteries under the influence of the will. To effect it well requires a considerable effort of the will, which can be maintained, in children especially, only for a short time—for a few minutes in little children; and the attempt to enforce it longer, if unfortunately successful, leads to exhaustion of the power to make the effort, in short, creates inattention, and the frequent repetition of the process renders the inattention habitual. The more intense the effort at attention the more true is this. Yet the cultivation of the habit of quick fixed attention, which implies the restraint of wandering thought, constitutes the most essential feature of good education. Upon it briskness of apprehension, memory and mental power, in great measure, depend. It may indeed be regarded as the corner stone of the intellectual

building. We may endeavour to pile up any amount of material; but unless it is laid upon this foundation it will prove a crumbling and useless heap. Good bodily vigour is necessary for it. When weak, languid, or tired we cannot apply our minds effectively, that is, we cannot closely attend to anything; and we have greatest difficulty in doing so with regard to the subjects which interest us least.

Much has been written, by Chadwick and others, on the evil done by the length of time during which children are kept in schools and expected to bend their minds to subjects which, uninteresting in their nature, are rendered still more so by the manner in which they are taught; and of the truth of the allegation there can be little doubt. It is, on the face of it, absurd, or worse than absurd, that children should be pent up in ill-ventilated rooms for the space of two and a half or three hours at a stretch over dull lessons. Such treatment necessarily prevents the acquisition of the habit of attention, induces idleness, carelessness, apathy, and dulness, enervates both body and mind, and brings large numbers to the condition of having learned one thing only thoroughly, and that is to hate learning. Better results may be expected from an extension of the "half-time system," and the employment of the hours wrested from books in mechanical preparation for various trades, in military exercises, athletics, and so forth, as well as in acquiring some knowledge of music, of plants, of the habits of animals, and other subjects which will excite interest, command observation, and add pleasure to life.

Much has also been written, and with a good deal of truth, on the evils resulting from the high-pressure system in education, which is deemed requisite to prepare students for examinations, and to enable them to contend for the many prizes offered for competition at an early period of life. The stimulus of gain and ambition is resorted to, to counteract the dislike of learning, to which I have referred, and leads, no doubt, in many instances, to further evils.

In this age of increasing nervousness, which means susceptibility to impressions or sensibility, the effects of overtension, or overstrain, of the nervous system are peculiarly to be dreaded. They are very insidious, often attributed to laziness, are slow to be recovered from, and are a very frequent cause of break-down in the student's career. Many, from this cause, fail to reach the examination goal. Many, having reached it, had better never have sought it. Some require long periods of repose to regain the elasticity which heavy pressure has weakened, and to refit them for further work. Some never do regain it, and live on to disappoint the hopes which early dis-

tinction had raised. It has been my lot to watch many instances of these results, and, I hope, in many cases, to prevent them by strong remonstrances against the seducing but enervating *nocturna lucerna*, and by urgent advice to transfer some hours from work to rest and play, and by instilling the most wholesome maxim: *otiare quo labores*. Happily the play-ground and the river come more and more to the fore as the compensations for the schoolroom and the examination-hall; and the ambitions of parents are set almost as much upon successes in the former as in the latter. Their instincts tell them, rightly, that it is not by learned feebleness that the race of life is to be won, that the strong, well-knit, and elastic frame is best to be trusted as the home and agent of the sound and effective mind. As I have watched with interest the quickly-growing tendency to increased education of women, and the desire in women to match themselves in the mental arena against men, together with the rise and successful progress of Girton and Newnham Colleges, in connection with my own University, it has not been without apprehension that the associated strain and excitement might act prejudicially upon the sensitive fabric and the finely-strung nerves of the woman. I could not but feel that the consequences to her, and to those who are to come after her, of any deterioration of her physique would be ill repaid by any results that education could bring; and I certainly think that the less of mental competition she has the better it will be for her. At the same time it is satisfactory to mark that the movement has been attended by a corresponding enlargement of the range and amount of bodily exercise. The gymnasium and the lawn-tennis ground are the antidotes, and therefore the correllatives, to the study; and we may have good hope that the increased and well-balanced exercise of mind and body will lead to a better development and greater strength of both.

A few words on the subject of ventilation. Good fresh air and light are the first requisites for health. Our gardens tell the necessity of them, even for plants, and show that the more the plants are shut up from them the more liable they become to blights and disease, and to imperfect development of colour and form. Fresh air means air in motion. We are quickly conscious of the difference to our powers of work, of attention, or of exercise in a closed room and in one open to the air, on a still day and in a brisk wind, in a screened wooded valley, and on a hill top; and we know that still air is peculiarly favourable to the development of the various organisms which give rise to putrescence and communicate disease. The ventilation and lighting of his house is, to some extent, in the power of each man and is commonly far too little attended to, especially in the

bedrooms. These are generally stuffy, with closed and curtained windows, and are replete with emanations from beds, clothes-boxes and various accumulations under the beds, and dusty corners. The admission of air, scanty during the day, is permitted at night only through the chimney; and often there is not even that sooty channel. Our open fires, needlessly wasteful and therefore costly though they be, are no doubt, a very salutary influence; and they make the contrast between English and foreign houses, which latter are for the most part heated by stoves, much in favour of the English. Still the English houses admit of great improvement, which can be easily made. The air which passes up the chimney from the fire must be supplied through some inlets. Hence, when windows and doors are closed, it comes through crevices in the boards, carpets, &c., bringing with it various impurities; and too often demands are made upon the water-closets and sink-traps. The ill-fitting of the doors and window-sashes of the houses of the poor, serves the good purpose of providing ventilators. But the better houses have not this safeguard; and, as dire experience in high quarters tells us, their inmates too often pay serious penalty for good carpentry added to that apprehension of draughts which is maintained by an ignorance, or an ignoring, of the fact that fresh air is one of the best preservatives against cold and rheumatism, as well as against fevers and debility.

People go to the seaside and bathe themselves all day long in air, and then wonder that, on returning to their pent up houses, they feel unwell, perhaps more so than if they had not left them. The amount of three thousand cubic feet per head, per hour, which has been computed to be necessary for the maintenance of the normal purity of the air, cannot of course usually be supplied; but care should be taken in every house that a ready supply of air is provided from the exterior, and that, night and day, summer and winter, some window, in the chief passages at least, remains open. In many houses there is a fanlight over the entrance. This should be made to open, which it easily can be, though it very rarely is; and it should be kept open, with very few exceptions, throughout the year. This change would make a great improvement in the sanitary condition of our houses. In the country cottages and houses the windows, especially in the upper storeys, are too small and too much closed; and it is distressing to notice how often the dwellings are closely beset or overhung by trees, which shut out both air and light. It were a wholesome rule that no tree should be allowed to stand so close to a house that it would touch it if it fell. But trees are too commonly planted without consideration of the space they will occupy, and the shade they will throw, when

they grow up; and when they have grown up there is a health-disregarding reluctance to cut them down. The courtyards and alleys in towns do not easily admit of rectification. The only effectual plan appears to be that of clearing them away and erecting buildings with better sanitary arrangements on their site, by which, as experience has shown, the mortality of the residents may be diminished without reducing their number. In the rural districts, however, the sanitary state of habitations might be easily and greatly improved by a little attention to the points I have mentioned, and at small expense. The freer admission of air and light obtainable by cutting down over-hanging and closely-adjoining trees, by enlarging and open-ing windows, by removing curtains, useless furniture and old clothes, by clearing out dusty corners and cupboards, and by filling up stagnant ditches and ponds, would do much to render our agricultural population healthier and stronger, and more vigorous and active in mind and body than they are, and would lessen consumption, rickets, scrofula, fevers, ague, and other maladies, as well as the poor-rates. In short, the small sums thus expended would be well invested, for they would bring a rich return, in the form of abler bodies, with attendant mental and moral improvement, to the land-holder and the farmer, and would enable them better to contend with the foreign producer and the vicissitudes of our home climate.

There is little prospect of these last becoming more favour-able. Moreover, the temptations away from agricultural labour, offered by the higher wages and other attractions of town-life, are yearly increasing. The agricultural labourer is there-fore becoming a more rare and valuable article; and to improve his sanitary and general condition is the material interest, as well as the bounden duty, of those to whom the land is en-trusted. Indeed, we must look to the application of sound sanitary principles to the land—to those, both men and animals who dwell upon it, and to the food-producing plants which grow out of it—as one of the most certain and obvious means of restoring to a prosperous condition that which is still the most important of all our commercial bases, the agricultural business of the country. Some of these sanitary principles, those more especially which relate to men and animals, are clear and ready to be applied at once. Others will require long investigation at the hands of persons who shall be assigned to it, and who shall devote themselves to it in the feeling that they are workers in a great science which must be fraught, more, perhaps, than any other science, with lasting benefit to the human race.

The important points of house sanitation, water supply, food,

engineering, and the great sewage question which it will take some generations satisfactorily to settle, will be discussed in the various sections and need no comment from me. The influence of climate, temperature and locality, including geological formation and elevation, upon health and diseases form subjects which the British Medical Association, through its Collective Investigation Committee, is already enquiring into, and hopes to pursue more fully. These are associated with the investigations into the LIFE-HISTORIES of individuals and families, which that Committee is about to prosecute. The Committee is, indeed, at the present time engaged in preparing a suitable album in which the medical and certain other records of the life of an individual may be made and preserved in the most convenient manner, so that the various phenomena bearing upon longevity and disease—such as hereditary predisposition, temperament, occupation, water-supply, locality, exposures, illnesses, &c.—may be noted and read off at once, and be available for determining diagnosis and treatment in illness, decision as to course of life, and other problems. The advantages of such a system to the individuals themselves primarily, and to the community at large, if it be at all generally adopted, is obvious; and the effect of it upon sanitary and medical science, if well carried out, can scarcely be over-estimated. Among other results, it may be anticipated that it will, in course of time, assist to determine the regions and surroundings most suitable to persons of particular temperaments and tendencies. Instead, for instance, as at present, of simply certifying that individuals are sound in body and mind, and therefore fitted for the Civil Service in India, and so drafting off those who are best fitted to remain in England, the medical or sanitary examiner should be asked to indicate those who would be better in India than in England, and, therefore, most likely to be advantaged by the change. Thus a benefit would be conferred both on England and on India, as well as on the persons more immediately concerned. The same applies to our other Colonies and possessions. In this way the vastness of the Empire, embracing every climatic and geographical variety, may be made a means of improving the sanitary condition of its numerous peoples; and some compensation may be made to the inhabitants of distant lands for the maladies and evils we have carried to them.

Of the cholera I will simply say that I trust the apprehension of it, whether it reaches our country or not, will be turned to good account in clearing away those foulnesses upon which it and other like maladies feed. If its presence be needed to effect this, then in spite of its being, as my slight experience of it told me it is, one of the most awful of maladies, its advent

may prove a blessing. Whatever may be the view about the cordon of quarantine there can be no doubt about the desirableness, in the *first* place, of paying more attention to the condition of vessels, their cargoes, passengers, and crews at the various ports of departure, it being well known that vessels often go to sea in a condition which greatly favours the development of infectious disease, and, *secondly*, of so setting our houses in order as best to modify its shock. To be forewarned in this case—and to have perhaps a year's forewarning—gives the blessed opportunity to be forearmed. Let not the opportunity be lost.

On one point I can safely rely upon your hearty agreement with me, viz., that in addresses of this sort the "half-time system" is peculiarly applicable.

I will conclude, therefore, by the expression, in which also you will agree with me, that this Institute has a great and most valuable future before it in the work to which it allots itself—the work of making man's body healthier, stronger, and better—a work in which He who had the greatest power over man and the greatest sympathy with man was largely pleased to exercise his power. In the prosecution of that work the Institute can scarcely adopt a surer and better method than by carrying out its provisions for the examination of surveyors and inspectors. I trust that these examinations may, each year, have a wider influence; and I beg to commend to the Institute the serious consideration of one of the points I have ventured more especially to bring before you this evening, viz., the importance of the formation of a separate and efficient department of the Government for the superintendence and improvement of the sanitary condition of our towns and villages, of our navy and army, of our ships and their cargoes, as well as of our cattle and of our food-bearing vegetables, and which should also take the necessary steps for a proper education, tested by examination of all who are appointed inspectors of nuisances, sanitary surveyors, and medical officers of health. This I feel to be the great desideratum of our time—the thing we should most strenuously strive to obtain. One means of effecting this, as I have already hinted, would be the promotion of a better representation in Parliament of the medical profession, and of those who have shown themselves to be interested in sanitary improvements. I think also it might be in the power of the Institute to do much good by the circulation, in a cheap form, of simple hints as to some of those sanitary improvements which may, without difficulty, be effected in our homes and their surroundings, in our dress and our food, and in the general management of our children and ourselves.

The LORD PROVOST—I am sure you will permit me in your name to convey to Professor Humphry the very high regard we have for him for the able lecture which he has so kindly delivered to us. It will be out of the question for me to propose to review that very excellent address, far less to criticise it. I am sure if I attempted to do either the one or the other, I would not be doing that which you desire. We cannot but deplore with Professor Humphry the insanitary condition of the British army when in the field, and dread a repetition of what took place in the Crimea. I therefore do hope that our legislators may have their attention directed to the question brought before us by Professor Humphry with the view to a remedy, because we cannot tell the day when military sanitation may again be as important as it has recently been in Egypt. I dare say the present company will feel as gratified as I do at the compliment paid to the Scottish nation, but probably more was said than we would be inclined to endorse There is, no doubt, a great influx of people from this part of the island to the south. But we have always been in the habit of regarding the south as a field to which we go, not so much to improve our neighbours as to better ourselves. I hope the very wholesome remarks regarding young life made by the Professor will have due weight in those quarters where such advice would be most useful. No one who has given any attention to sanitary matters at all but must know that in early life the seed is sown of a healthy or unhealthy manhood; and therefore it is of the highest consequence that great care be given to the human body in these early years. I have as much reason to regret the absence of our old friend Mr. Chadwick as Professor Humphry. I am quite of the same opinion as Mr. Chadwick, that the cap which Manchester puts on would in many respects also fit Glasgow. I wish that eminent sanitarian were here this evening to give us a warning. I am sure we would have taken it in good part. I trust that the suggestions Professor Humphry has thrown out will be considered by those to whom they were more particularly addressed—namely, the Government; and that in the future more than in the past our Legislature will attend to sanitary matters rather than to other matters which appear to them of great importance, but which to us sink into insignificance when compared with those which affect the health of the nation.

Dr. A. CARPENTER—As chairman of the Council of the Sanitary Institute, I rise to second the proposal that has been made to you by the Lord Provost, that we present a hearty vote of thanks to Professor Humphry for his very able and conscientious address. I have some diffidence, after the observations that have been made by the Professor, as a Southern man in appearing before an audience like this, the more so, because as the professor went on I gathered that we had to come to the north not only for brains, but for those very fine feet that we have sometimes in the south, because as I came through your country I observed many persons without shoes at all. I could see the perfection of the form of foot to which the professor has alluded,

and I was satisfied that the discomfort they had without a shoe was given back to them in that beauty of foot and in that freedom from certain disturbances of health that do follow from the confinement in which the foot is kept by those extraordinary articles that are put on them by the shoemakers. But then I observed also that the Professor alluded to education, and I had some recollection that Scotland had taught us a lesson in respect to our schools, by teaching children in the open air, and had sent so many prime examples of great intellects to the south. Then he got on still further, and talked about the Parliamentary representation of the medical profession, and I recollected that Glasgow had done honour to our profession in sending a member of that profession to represent her in Parliament. I do hope that the experience we have gained of the good effects that follow from certain proceedings of the Scotch may have a beneficial influence upon the south, as much as we hope to have a beneficial influence upon you. I never listen to Professor Humphry without gaining some knowledge. I have sat at his feet for many years in various ways, and the address that he has just given has still further convinced me that he will always have something to tell us, something that is instructive, something that is certainly worth hearing. I am sorry that every member present tonight has not brought his wife or his lady-love with him that they might have heard the stirring words which have been addressed specially to the feminine portion of the population. I have great pleasure in seconding the proposal that the Lord Provost has made.

The motion was then put and carried with great applause.

Prof. HUMPHRY—I must return my hearty thanks for the kind manner in which you have listened to me, and still more for the very kind expression of your feelings which has been made by the Lord Provost, by Dr. Carpenter, and yourselves. It ill becomes me, perhaps, to find any fault at all with what falls from one who is so thoroughly and deservedly respected and esteemed by you all, but the Lord Provost did mention one word to which I must take exception. He said that I had paid a compliment to your nation; it was not a compliment, but a simple expression of the truth. Those of you who have in the newspapers lately read the report of the Anthropological Committee of the British Association have, doubtless, seen there that it was no compliment, but, as I have said, the truth, for you will observe that, according to the measurements of that committee, the Scotchman is a taller man and is a stronger man than any other in the empire. In saying that he is taller and stronger than any other in the empire means, I apprehend, that he is taller and stronger than any other in the world. We know that his brain weight is greater than that of any other, and I say also that we cannot help knowing that his brain force is greater too. It may be added the manner in which the Lord Provost has been good enough to express his approbation of the efforts of a Southron to address you this evening is no bad illustration of Scottish character.

SECTION I.

SANITARY SCIENCE & PREVENTIVE MEDICINE.

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ADDRESS

By Prof. W. T. Gairdner, M.D., LL.D.,

PRESIDENT OF THE SECTION.

In the course of the duties which fall to my lot as a teacher of the healing art, I am obliged, as it were, to appear in two characters, because the art itself falls practically and conventionally, if not naturally, into two divisions—separate in idea, and yet, as we shall presently see, inextricably interwoven. "How is this individual patient to be cured of his actually existing disease?"—is the first question to which the art of medicine in all ages has invariably and inevitably addressed itself. How is disease—*i.e.* premature death, disabled faculty of body or mind—to be reduced to a minimum, and as far as may be got rid of, for humanity at large?—this is a second and a far more comprehensive question, in the course of answering which, when he attempts a reply at all, the physician hopes chiefly to get some additional light as to how to deal with the first. In addressing himself to the first question, the physician is led to view diseases simply as so many separately existing facts or species which have to be classified and set apart like objects of natural history, in order that the experience of many men in many ages may be brought to bear on the great question of their cure. And although there have never been wanting philosophic minds which have looked behind this conventional view of a disease, and endeavoured to obtain an insight

into the causes of disease in general, yet it must be admitted that the habitual attitude of the physician towards his patient in all times has predisposed him to accept empirically, as it were, the disease as an existing fact, and to direct his whole energies towards the question how the individual patient, being already ill, can best be treated so as to emerge whole and sound.

Prevention of disease, the great object of modern sanitary science, has too often been regarded as unprofitable; not merely in the coarse sense of being unremunerative, but also in respect that the inquiry into causes belonged for the most part to the class of speculations condemned by the inductive philosophy as destitute of fruit, and therefore wholly insecure and unpractical. Causes were scholastically divided into predisposing, exciting, and proximate; but of these, the last came to be regarded as an idle and metaphysical research, while the others gave rise to long dissertations, not without value, but certainly in most cases without much precision of method or obvious benefit to mankind. In very many instances, accordingly, the physician who applied himself to the study of causes was adjudged to be only losing sight of the object for which he was consulted by suffering humanity; while he who directly applied himself to the cure, and to nothing else, was glorified as being alone, in the real sense of the word, the mediciner, *i.e.*, healer or practical man. And the rewards of professional life being mostly reserved for services of this kind rendered to individuals, the inquiry into causes was necessarily discouraged, and disease came to be largely dealt with as a "visitation of God"—inscrutable in its nature and essence, but yet requiring to be attacked and subdued by remedies, many of which were violent, empirical, and dangerous in their action, in proportion to the supposed danger of the disease.

It was impossible, however, that this onesided view of the nature of diseases should satisfy all minds—or indeed the best minds—devoted to the healing art in any age. All through the history of medicine we can observe the effort to get insight into causes, not merely as a philosophical speculation, but with a view to prevention. The treatise in the Hippocratic writings on airs, waters, and places is one of the earliest, and certainly, in its time, one of the most surprising advances in this direction. The curious and instructive studies of epidemic diseases in the same group of treatises, partly by Hippocrates himself and partly by his successors, give glimpses of insight which it required centuries to develop into principles of secure action, either as regards the prevention or the treatment of such diseases. On the other hand, the almost entire neglect of sanitary research by Sydenham, confessedly the greatest of

English physicians in the 17th century, even when writing at large upon epidemic diseases, shows how few were the principles of preventive medicine that had emerged out of obscurity, even in comparatively modern times; and the long struggle with ignorance and confusion which was required to establish even so simple a case as the dependence of scurvy on an insufficient amount of vegetable juices in the food, shows as well as anything else that up to the very beginning of the present century the attention of physicians was but feebly attracted by facts and doctrines which, had sanitary science existed in any real sense, could hardly have failed to become generally accepted. That it should have taken two centuries to reduce to a practical rule in the navy of Great Britain the measure by which Commodore Lancaster saved his crew from scurvy in 1603 is one of those facts which cannot be got over, and which show that, in a practical sense, preventive medicine and the effective study of the causes of disease is a thing of yesterday as compared with the ages of effort, not wholly unsuccessful, devoted to the cure of diseases. And although the discovery of vaccination alone is enough to redeem the credit of the medical profession during the last hundred years, yet it cannot be said generally that in the great sanitary movement of the present age eminent physicians have always led the van of progress. No one speaking in this place should acknowledge otherwise than with profound gratitude and respect the labours of Edwin Chadwick, of Lord Shaftesbury (then Lord Ashley), and of Lyon Playfair as the pioneers of English sanitary science. Yet it would have been impossible for these distinguished men to have accomplished what they did without the co-operation of medical men, and even of medical authorities. Indeed, the names of Southwood Smith, Neil Arnott, and James Phillips Kay are associated with the movement in this country from its very beginnings in 1842. But the impulse, so far as the general body of physicians was concerned, came from without rather than from within. And it is not to be forgotten also, that M. Pasteur, the most distinguished of living Frenchmen as regards the scientific investigation of the causes and prevention of epidemic diseases, is not a member of the medical profession.

But while it is true that medical science has not always been in a position to initiate discoveries, or to take the leading part in legislation in the direction of sanitary progress, I think it may be claimed for my profession that it has very cordially accepted, and energetically carried out, sanitary reforms of every kind so soon as they came within the scope of practical application by the physician. Of no body of men can it be affirmed with less truth that they have encountered the great

reforms of the last forty years in a hostile or narrowly professional spirit. There was, indeed, an evident possibility that it might have been otherwise. To work towards the prevention of disease deliberately and effectually was not only not remunerative, but might have been construed as directly attacking the sources of income. Yet I believe it will be readily admitted that with all but a small and utterly insignificant fraction of a noble profession this consideration has been practically devoid of influence; while the names of John Simon, William Budd, Charles Murchison, Edmund A. Parkes, John Snow, Edwin Lankester, and many others show that even a considerable measure of success as medical practitioners, in the ordinary sense of the word, is in no way inconsistent with eminence and originality of research in the department which has been called in our programme "Sanitary Science and Preventive Medicine."

One name, that of one recently removed from us by death, deserves a separate mention in this connection, in order that we may join in paying a tribute of love and admiration to a character in which eminent and exact science was singularly blended with gentle humanities and modest personal worth known to many of us here—one who, occupying throughout a long career a position subordinate in his official relations, was able through sheer force of genius to influence the cultivation of sanitary science all over the world, by his love of order and method, as well as by the luminous power of exposition he displayed in dealing with what to most men would have been extremely unmanageable and dry arrays of figures. It is not the first time that I have had occasion to express in public my own personal sense of the enormous debt which sanitary and medical science owe to the late Dr. William Farr; and I will venture to quote to you now a few words written in 1861 when, in the course of what I believe was the first separate course of sanitary instruction delivered to medical students in Scotland, I had occasion to expound in some detail the elements of the science of death-rates* :—

"Dr. William Farr has done for the vital statistics of England almost what Harvey did for physiology or Lavoisier for chemistry. He found the facts of this science in a state of almost hopeless and aimless confusion. He has not only added immensely to the number and value of these facts, but has brought into them light, harmony, order, and, for the first time in the history of the science, a determinate method and an approach to scientific exactness. On the basis of millions of separate details, arranged, on the whole, in a very close and accurate

* Public Health in Relation to Air and Water, 1862.

accordance with medical opinion, and with the demands of sanitary science, it has been the great and enduring merit of Dr. Farr (originally a modest country practitioner of the Company of the Apothecaries) to build up a body of doctrine on vital statistics, not only unequalled, but unapproached in any other country. By the systematic calculation of death-rates he has placed an easy and useful method at the service of all enquirers into the public health,—a method certainly not without risk of error in its application, but giving facilities for the elucidation of truth, and the correction of error, which render it of the utmost value to medical science. By the formation of life-tables from these data, Dr. Farr has also immensely aided the operations of life-insurance; and, by the vast extent of his general information, the vigour of his literary style, and the genial current of his human sympathies, he has been able to invest his dry and abstract enquiries with not a little even of a popular, almost of a poetic, interest. Those who have occupied themselves with the reports of the Registrar-General, or with the most instructive and interesting historical dissertations in the report on the census of 1861, will assuredly join with me in giving to Dr. Farr the credit of having at last solved the problem of investing numbers with a correspondingly real interest, and made large blue-books, and big ones too, among the most stimulating and suggestive productions of the age."

It is somewhat painful and discouraging to have to add to these few lines of very moderate eulogy on a now departed benefactor of mankind, that he who thus gave an impulse to preventive medicine and sanitary science amounting almost to the discovery of a *Nomum Organum* for it, was in the end obliged to retire from his work on behalf of the nation with so little of what can be called national recognition of his vast labours and eminent services to the State. It is my earnest desire that these words should be taken in a sense void of offence—*i.e.*, as not imputing blame to anyone in particular in connection with Dr. Farr's resignation of his office, which was unquestionably made necessary at the time by the state of his health. Nor is this expression of regret in any way inconsistent with the opinion that I have always held and expressed, that the medical profession will not advance its own best interests, or the interests of humanity committed to its care, by entering into the competition for honours, dignities, or emoluments at the hands of those who represent the nation. The claim of Dr. Farr to such recognition was not in respect of his being a medical practitioner, but in respect of his being an officer of State, and one who, in almost every particular of high character and unique distinction, must be considered to have justly earned the very highest rewards that the

nation, as such, had to bestow. I hope you will join me in thinking that it is not creditable to us as a people that such services as his cannot, apparently, be more generously rewarded and more highly distinguished during the lifetime of their author. The subject is one, perhaps, not altogether for this Institute; but I have taken the liberty of alluding to it because I happen to know that a proposal to reprint one or more volumes of Dr. Farr's invaluable papers, prepared by himself for such publication, is at this moment in suspense, as it was during his lifetime, because the modest salary of a Government official, and the scanty provision left for his family, did not allow of this being done at the cost, or even at the risk, of those to whom his fame is most dear. Would it not be possible, by a combination of influences emanating in part from this Institute, to secure the co-operation of medical and sanitary inquirers all over the world to this, the best of all possible monuments to Dr. Farr, before the lessons of his life and character have ceased to be vividly present to us? I believe that such a work, could it be provided for either by subscription, or through some society a portion of whose funds might properly be so invested, would become a means of education in sanitary science of the highest possible importance; while a prefatory memoir of the author, carefully and judiciously edited, would leave a moral as well as an intellectual impression which would go far to correct the chilling results of neglect hitherto, and preserve the name of Dr. Farr as an invaluable heritage, not for us only who knew him personally, but for likeminded men everywhere, now and in all coming time. If I earnestly press upon those who are present on this occasion to do what is possible to convert this aspiration of mine into a reality, it is because I believe the future of sanitary science largely depends upon the appreciation of the unselfish labours of those who have devoted themselves to its cultivation in the spirit of William Farr; and I would add as another great living exemplar—John Simon.

In looking to the future of sanitary science and preventive medicine, it is impossible not to anticipate that it will be as cordially aided by the medical profession in the time to come, as it has been in the past. But just as it has grown in importance and in public appreciation, preventive medicine has also become, not unnaturally, more exacting. It demands a special education, special qualifications, special offices and emoluments, and in these offices the devotion of a man's whole time and energy to preventive and sanitary work alone. I am very far from disputing the propriety and necessity of this arrangement in many cases. But I wish to point out that it carries with it the seeds of an evil influence which it is

desirable, as far as may be, to hold in check. The limitation of sanitary functions to men not engaged in medical practice, and of the practice of medicine and surgery to persons who are, or may conceive themselves to be, thereby exempted from all preventive duty, will not be without serious disadvantages. It will tend to split up the medical profession into two sections, perhaps into two more or less hostile camps. It may also tend to make the physician proper, the healer, less careful of the means and appliances of preventive medicine than he would otherwise become. Speaking from my own experience as a teacher, I would say that this would be a grave and perhaps irretrievable disaster to both sides. For the healing art is really, and in a very practical sense, one; and the cure of a disease, if it is to be anything else than mere empiricism, must be largely imbued with a preventive element. In other words, the careful and practical study of the causes of disease with a view to prevention is in many, if not in most, cases a large part of the cure. I have already alluded to the instance of scurvy, where it may be said that the cure emerges directly and exclusively from the knowledge of the prevention. And if it is not so plainly apparent in many other instances that this is so, it is probably only because of our comparative ignorance of the essential conditions both of cure and of prevention. The larger faith now existing in what are commonly called natural means of cure—*i.e.*, physiological as opposed to complicated and disturbing remedies—is the practical fruit of the free recognition of this truth by the medical profession.

Those who are old enough to remember, or who may even now know something about, the complicated and distracting array of medicines and of surgical proceedings which did duty for indispensable remedies in the last age, but which have now passed almost into oblivion, will be in a position to judge how much has been gained for the healing art, in its more limited sense, by the really enlightened modern study of the causes of disease. Were it even possible to suppose that this great advance, in the direction of true science and sound practice, should ever again be undone by the complete separation of preventive medicine from the healing art, the result would, in my opinion, be nothing less than a calamity, both for the one and for the other. It was a strong sense of the imperative necessity of maintaining this connection between curative and preventive medicine that led, more than anything else, to my acceptance, in 1863, of the office which alone gives me any claim upon your attention to-day. As a teacher of practice of medicine, already of some experience, and recently appointed professor of that subject in the University of Glasgow, I was invited by the

authorities to assume the responsibility of the sanitary administration of this great city as its medical officer. It appeared to me that whatever might or might not be the permanence of the connection, the initiation of so great a work was a task not only worthy in itself, but fitted to be of unknown advantage to the students of medicine who might be dependent on me for their instruction. On these grounds chiefly I accepted cheerfully, for what proved to be a term of nearly ten years, the labours and responsibilities of sanitary work. In the discharge of these duties I was aided by a staff of faithful and devoted officers, by the countenance and support of the authorities, and chiefly of that lifelong and still unwearied sanitarian who now sits in the civic chair. It is impossible for me ever to express adequately my sense of the permanent obligation I owe to these men, and to the work in which they were, and are still, engaged. Although the necessities of the city outgrew the original arrangements, and a greatly extended staff appeared to require a different system of administration, I was enabled to retire with a feeling of profound and lasting satisfaction in having acquired a store of literally invaluable experience as a professor of medicine; while, on the other hand, the work has been continued and advanced from year to year by one who has proved himself one of the ablest and most thorough-going sanitary officers in this country—our good friend, Dr. J. B. Russell. I could not venture in his presence to say all that I should desire to say of him, and of the whole sanitary department as at present administered; but I will venture to refer those who wish to know more about it in a compact but comprehensive form, to a paper by him in the "Transactions of the Epidemiological Society of London, Session 1881-82, new series, Vol. I," on "The Policy and Practice of Glasgow in the Management of Epidemic Diseases, with results." I have only time now to revert to some of the more striking incidents of my own decennium of experience.

During the period referred to—1863-72—we had to deal with several considerable epidemics, which revealed very clearly the weak points of Glasgow sanitation, according to the means and resources which then existed. Among these were a not inconsiderable epidemic of smallpox in 1863; closely following thereon, a really great and disastrous epidemic of typhus fever, lasting from 1863 to 1865, and never completely subdued until it was crossed and merged in a great outburst of relapsing fever in 1870 and 1871, associated with very great want, and misery of every kind, among the poverty-stricken classes who were mostly the victims of this fever. Measles and hooping-cough

also prevailed largely during the year 1871; and as a consequence, no doubt, of so much exposure and misery amid such epidemic conditions, inflammatory affections of the lungs and bronchi carried off nearly one-fourth of all who died during the year 1871, including, of course, an unusually large proportion of infant lives. Although, therefore, the types of epidemic disease which prevailed in these two years were not nearly so directly fatal as the typhus of the preceding seasons, from 1863 onwards, the death-rate continued high, and it was by no means under encouraging circumstances, except as presently to be stated, that I handed over the medical care of the city to my successor. As these various epidemics had revealed thoroughly our weakest points, there was, on the other hand, room for congratulation on our comparative immunity as regards two diseases which, during my term of office, had given rise to a very large epidemic mortality throughout the country. One of these was cholera, which, as is well known, became epidemic in London during the summer of 1866, and in the autumn and early winter of the same year spread very extensively over England and Scotland, causing an especially large proportion of deaths in Leith, and in some of the smaller towns and villages on the east coast of Scotland. In reporting on this subject on the last day of the year 1866, I was able to show that, notwithstanding our terribly degraded and overcrowded population, still living under the scourge of a previous severe epidemic of typhus, we had lost only one in 10,000 of the inhabitants from cholera in the four months, August to November, 1866, against 7·5 in Edinburgh, 6·2 in Dundee, 7·2 in Aberdeen, 2·5 in Greenock, 5·4 in Perth, and no fewer than 24·4 in Leith. Nor was this because the epidemic influence was wanting; for during the same period more than 700 cases of diarrhœal disease were reported and carefully investigated at the Sanitary Office, 108 of which had more or less resemblance to cholera, and were indeed considered as being in all probability cases of that disease, though often in a milder form. Our comparative immunity was universally attributed—first, to the all-important fact of our having a perfectly pure water supply; and, secondly, to the elaborate arrangements made, under the sanction of the Magistrates' Committee, for dealing with the individual localities and persons affected, in the way of cleansing, disinfection, isolation, &c. But of these arrangements in detail there is no time to speak at present. They were, however, approved by almost all classes of the community, and brought out in a remarkable manner the active sympathy and Christian co-operation of all the churches, as will appear from the perusal of a special report

published on the subject in May, 1867.* The other instance in which a very marked check seemed to be imposed by sanitary preventive measures upon an epidemic disease actually widely spread in Scotland at the time, was small-pox in 1871. Not to trouble you with the figures in detail, I will only say that, with one exception (Paisley), Glasgow showed in that year the smallest percentage of deaths from small-pox in all the principal towns of Scotland; and that even with its vast and fluctuating population, open to every kind of epidemic calamity, it has never since been in any considerable degree a prey to that disease. There can scarcely be a doubt, I think, that the attention given to vaccination and re-vaccination from 1863 onwards, as the result of the persistent pressure of the sanitary staff, has been in a considerable degree the cause of that immunity.

In these two instances, then, we were enabled by special circumstances and precautions, the direct result of preventive medicine, to hold our ground in some considerable degree against very serious and appalling epidemics. Why were we not so in the cases already referred to of typhus and relapsing fever? Not, I believe, because these diseases are essentially less amenable to preventive medicine than cholera or small-pox, but because the machinery with which we had to work was wholly inadequate to grapple with their causes. Typhus fever is emphatically, as has been often demonstrated, the epidemic disease proper to overcrowded communities; relapsing fever is the occasional supplement, or additional emphasis, which arises when to habitual and extreme over-crowding there is added the presence of something like famine, or at least a grave and general destitution as respects many of the first necessaries of life. In Glasgow we have long suffered, and in the decade referred to we suffered in a very high degree indeed, from both these causes of disease. This fact was so evident on the surface that it could not but attract at once the attention of the medical officers; but their efforts to deal with it in the face of an epidemic actually existing were from the very circumstances of the case foredoomed to comparative failure. In the spring and summer of 1863, I made, along with Mr. Carrick, the city architect, and his assistants, a minute and detailed personal investigation of all the localities in which fever had been reported to us as having taken an epidemic hold, and the results of that investigation were communicated to the authori-

* Report to the Superintendents and Visitors in the recent Sanitary Visitation Movement, with considerations as to a permanent scheme; also proceedings of Public Meeting and Appendix of relative documents. Glasgow, May, 1867.

ties in October, 1863, as well as in some earlier and later reports. In many cases, and wherever, indeed, we had reason to believe that improvements could be effected by persuasion, without force of law, we were careful to ask the attendance of the owners or factors of property in the epidemic localities; and in very many, indeed in most, instances we were cordially met, and more or less supported in our suggestions for immediate improvements. Windows not opening at the top, for instance, were dealt with by scores, if not hundreds, and although our instructions were no doubt occasionally evaded, they were rarely entirely disowned. At the same time, disinfection of houses and of clothing was assiduously enforced, one of the first acts of the newly constituted Sanitary Department being the erection of a special washing-house and other necessary apparatus for this purpose, at which infected clothing and bedding were carefully dealt with in the interest of the community, and free of all expense and trouble to the parties.

Dr. Russell, in the paper I have already referred to, has told in a connected form the tale both of our difficulties and our partial successes, especially as regards the provision of hospital accommodation for the fever-stricken sick; and how it was a necessary condition, under the first Glasgow Police Act, that a disease should have become frankly epidemic, and been formally so proclaimed by advertisement, before any special powers of dealing with it could be obtained; in other words, that the stable door should be carefully locked only after the escape of the steed had become a very patent fact. But apart altogether from this flaw in our legal machinery, the impression conveyed to our minds, even while using to the utmost the powers then existing for the suppression of typhus fever, was (as I often expressed it) that we were merely scratching the surface; and that as long as the great tenement houses—well called "rookeries," and sometimes "warrens," which abounded in all quarters, but chiefly in the central district, were allowed to exist unreformed, and to be occupied by a class of population constantly deteriorating with the deterioration of the buildings in which they dwelt, there could be no adequate grappling with the problem before us. Two of these "rookeries," as early as July, 1863—one in Argyle Street, the other in the Drygate—had been singled out by us for experiment, in respect of the compulsory diminution of overcrowding, according to the Glasgow Police Act. In one of these I remarked, in first reporting upon it, that "the average size of the rooms (all single apartments) intended for the habitation of a whole family is but little greater than that formally condemned by a Royal Commission as insufficient for a single soldier in barracks." The actual average

of all the single apartments in this immense and complicated building was 497 cubic feet, and the actual occupation of them when our operations began was from three to five persons (in one case six persons) in each single apartment. The Glasgow Police Act gave the power, in such extreme cases, of disallowing altogether the occupation of apartments so small as the above, and thus of putting pressure on the owners to convert single-room houses into "room and kitchens;" and even then power was given to limit the occupation in accordance with a maximum stated in the Act, and indicated in each case by a ticket attached to the door. These powers gradually came into operation, not only in the two large tenements here indicated, but in many others, so that before August, 1864, we were able to report 6360 houses—*i.e.*, individual holdings, mostly single or double apartments—as being under police regulation as "ticketed houses"—*i.e.*, houses the occupation of which was subject to be ascertained by domiciliary visits of the police, and was supposed to be regulated in accordance with the provisions laid down in the Act. In the course of another year (August, 1865) we were able to report a great improvement in the condition of our two first-mentioned "rookeries," which had almost ceased to be fever generators even while the disease was advancing in the city at large. But this temporary immunity of two of the most notorious fever dens, under the extremely stringent regulations adopted, did not carry the conclusion that enough had been done. In the same report that records this immunity, it is affirmed that "without entire reconstruction neither of these properties can be regarded as being brought into a state of proper sanitary regulation." The same remarks might doubtless have been made as regards very many other properties, and especially of a great many in the narrow closes lining the High Street, where a population amounting to nearly 1000 persons on each acre of ground was in constant danger from overcrowding, in many cases in single apartments forming part of large blocks of buildings, with dark airless accesses, and almost every aggravation of nuisance and discomfort—too often with intemperance, immorality, and crime hovering in the track of disease and destitution.

The Glasgow Improvement Act.

It was under these circumstances that the late Lord Provost Blackie, in conjunction with the city architect, Mr. John Carrick, and other well-known and philanthropic minds, devised the now famous, and I believe really most effective, City Improvement

Act,* which was intended to sweep away (but not so suddenly as to give rise to great inconvenience) a large number of those closes and wynds where the worst sanitary features existed, and where, at the same time, there was a prospect that after the clearances a better class of houses might probably take the place of those removed. The administration of this Act has been much canvassed, and even unfavourably criticized in detail; but that it has very greatly diminished the hold of epidemic disease on the parts of Glasgow which it affects, no longer admits, in my opinion, of any reasonable doubt. Now, epidemic disease, from the enlarged and modern sanitarian point of view, is not only a great evil in itself, but also an index to other physical evils of at least equal importance. My attention, as medical officer for the city, was strongly directed to this fact, in March, 1869, when a wave of apparently climatic disease, specially characterised by an enormous increase in the mortality from acute diseases of the chest, swept over the city, and arrested much attention and remark. The Registrar-General in his reports at the time had ascribed this phenomenon almost exclusively to the "northerly and easterly winds" then prevailing. This and many other popular theories of the matter appearing to me inadequate, I made as careful a research as the available returns then allowed into the whole details of this singular increase in the death-rate, hitherto, there was reason to believe, almost unexampled in Glasgow. I found that while it amounted here to 30 per cent. excess in 1869 (as compared with the corresponding period of 1868); in Greenock the excess was 25 per cent., while in the large towns of the east Coast—Edinburgh, Leith, and Dundee—the excess was scarcely more than half as much, and in Aberdeen the difference was quite insignificant. Further, it appeared on more careful analysis that while the excess of mortality was greatest in acute pulmonary diseases, and specially great among the young, the zymotic diseases contributed to it not a little, and also tubercular affections, and among these in a very marked way the nervous diseases of infancy (tubercular meningitis, convulsions, teething, &c.), as contrasted with those of advanced life (apoplexy, paralysis, &c.), which latter showed no tendency to increase. It seemed impossible, therefore, to overlook the evidence that, besides possible climatic causes, there were others operating largely in the case of Glasgow and Greenock to

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* An interesting account of an early experiment in the same direction, on a small scale comparatively, but guided essentially by the same principles of active beneficence as were at work in promoting this Act of Parliament, will be found in the Transactions of the Social Science Association for 1859, by Sir James Watson, whose administration afterwards of the City Improvement Act did much to reconcile it to adverse public opinion.

determine so much larger an increase of the death-rate in their case than in that of towns more exposed to cold winds; and that while these could not be excluded from consideration, "the true sources of the excessive liability of Glasgow to such tides of disease and death are to be sought, not in these comparatively accidental circumstances, but in the permanently acting causes of high death-rates, and especially in the low standard of domestic comfort, the overcrowding, general squalor, and physical degradation which are the unhappy characteristics of a large part of the population; and that these again are the direct results of permitting generation after generation to be brought up in houses of the worst construction, in which morality, decency, and cleanliness are alike impossible."*

These conclusions were largely confirmed by further researches made during the years 1870 and 1871, and published in reports presented in the latter year and in 1872. An increase of the death-rate was again subjected to a careful examination, with improved means for its detailed analysis, and at once revealed the large share taken in its production by pulmonary and tubercular diseases, prevailing with increased force wherever the general death-rate was highest and the density of population greatest. Thus it became probable that not only as against zymotic diseases (commonly so called), but also as against those inflammatory, and even those chronic, affections of the lungs which form by far the largest factors in the death-rate, the true preventive medicine was to be found chiefly in improvements directed towards the ventilation, cleanliness, and general comfort of the homes of the poor; and that overcrowding and overbuilding of ground space especially were to be corrected, not only as conducing to typhus fever, but to many other diseases. This was the great object aimed at by the City Improvement Act; and while it was not permitted to me to witness, during my official career, its extended operation, I am nevertheless in a position to declare my belief that the policy so initiated was eminently beneficial, and that it is only by steadily following out the same principles that our great cities can gradually uproot the evils of centuries, and become even moderately healthy abodes for those who are attracted into them in search of work. Glasgow is a city peculiarly exposed to numerous causes of ill-health for its population, because (as I expressed the facts in 1871) "upon a relatively smaller acreage than any, excepting Liverpool, it is breeding

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* Report on the health of Glasgow for the first quarter of 1869, with special reference to the unusually high rate of mortality in March, 1869. Presented to the Board of Police by the Medical Officer, May, 1869.

up, from year to year, a much larger proportion of young lives than any other city. The inference clearly is that the sanitary state of Glasgow is in some way connected with its intense productiveness and its too small superficial area. And any one who is familiar with the high, dark warrens of closely-packed tenement houses in this city; its narrow, ill-ventilated closes; its many miles of such streets and closes, without an open space, without a blade of grass, without a tree or a shrub to be seen; its swarms of children pouring forth from such utterly wretched dwellings through dark passages and narrow lanes, with no playground but the street, no bathing-place but the gutter, can be at no loss to apply the moral of the tale which these numbers unfold." *

The improvements which have taken place since these words were written are very great, and most creditable to all concerned; but still, as Mr. Chadwick told us through the mouth of the president last night, there is much to do. Let us hope that the authorities of the present and of the future will, as Milton says, "bate no jot of heart or hope," but will go steadily on in the course that has been so well marked out for them.

Professor HUMPHRY, in moving a vote of thanks to Professor Gairdner for his most practical, most high-minded, and most philosophical address, said it was not to be expected that ever again in the history of sanitary science would they hear an address delivered by one who held the important and engrossing position of Professor of Medicine, and yet had devoted so much of his time to medical sanitary science. They could scarcely ever expect again to have the advantage of a man of high philosophical medical knowledge and science devoting himself to the work of clearing our city alleys and entering into the necessities of a great city to maintain its proper sanitary condition. Personally he felt, and he was sure the audience felt, that all humanity owed a debt of gratitude to Dr. Gairdner, that the city of Glasgow owed that debt in a very high degree, and that the Sanitary Institute and the present meeting were deeply indebted to him, not only for the great work which he had done, but for the lucid, clear, admirable manner in which he had put it before them in the address which they had just heard.

Captain GALTON, in seconding, said that as a military man he thought it was most satisfactory to feel that the early development of

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* Statistical Tables submitted to the Board of Police on Monday, 19th June 1871; showing the sanitary state of Glasgow, London, and Liverpool, from 1855 to 1870, &c.; with remarks by the Medical Officer. Glasgow, 1871.

sanitation in this country, at least of preventive medicine, had been very largely due to the medical profession in the army and navy. It was through the army and the navy that the interesting facts of preventive medicine had been brought so prominently before the public.

Professor GAIRDNER, in acknowledging the vote of thanks, asked that the Council of the Institute would favourably consider his suggestion in regard to the works of the late Dr. Farr, not perhaps so as to tie them to a movement in it, but simply that the gentlemen on the Council would give their individual consideration to the matter, and see how such a republication as he had alluded to could best be promoted.

Dr. CARPENTER assured the meeting that the suggestion made by Professor Gairdner would be considered by the Council, and if they could see their way to promote the object the Professor had in view, he was sure they would be ready to entertain it; at any rate he would take care that the proposition should be submitted to the Council.

On "The Distribution of Phthisis in the Eleven Northern Counties of Scotland, as ascertained by Statistics extending over a period of twenty-two years," by W. J. SIMPSON, M.D.

ANY additional inquiry into the geographical distribution of Phthisis, a disease which occupies the first place among the causes of death in Great Britain, cannot fail to be of interest to everyone, and more particularly to those who devote their special attention to the diminution, prevention, and cure of disease. Our existing literature on the subject is principally a collection of conflicting opinions. Of recent years high elevated lands are asserted to have a special freedom from Phthisis, and patients are sent to reside there on the assumption that mountain air will prove beneficial. The characteristics of mountain air are rarefaction, purity, dryness, and a large amount of ozone. As purity of air, dryness, and ozone, are found elsewhere than on the mountains, the chief influence is considered to be erected by the rarefaction of the atmosphere, or diminished barometric pressure. The same degree of immunity is, however, asserted to belong to Egypt, the steppes of Tartary, and other low lying places, and patients are sent to these situations where the barometric pressure is not diminished but increased.

Then, for various reasons, the Hebrides, Iceland, and New Zealand, have been held to be freer from Phthisis, than other countries.

Differences of opinion have prevailed, not only in regard to influence of high and low situations, on the prevalence or the non-prevalence of Phthisis, but also as to the effect of sea air, heat, cold, moisture, and other climatic factors.

We very much require definiteness on the subject, which can probably only be obtained from statistics extending over a large series of years.

In former times, and until registration began, it was almost impossible to arrive at any safe conclusion, for the mortality bills were for the most part not at hand, and those that could be got at were generally kept in an indifferent way.

The only statistical data available were those derived from the returns of the army and navy, in which the climates of Malta, Gibraltar, Corfu, the West Indies, and other places, were discussed in their relation to the frequency of Phthisis among the troops. However, the lessons they taught could not have been made much use of, for curiously enough while soldiers at the different stations on the Mediterranean when attacked with Phthisis were by the orders of the army surgeons sent on sick leave to Great Britain, civilians attacked in Great Britain by the same disease were by orders of their private physicians sent to recruit their health at the Mediterranean stations. Notwithstanding this it was never ascertained whether, in point of fact, those patients sent to the more equable and sunny climate of the South got better more rapidly or with greater frequency than the soldiers sent home to the variable and cloudy climate of Great Britain.

Dr. Haviland, a Fellow of this Institute, made the first attempt to put the geographical distribution of disease on a proper scientific basis. In his investigations into Phthisis in England he adopted the ordinary plan of comparing the total number of deaths from Phthisis with the mean population.

I have not however followed the same method of calculation, for I consider that by comparing, as he does, the number of deaths from Phthisis with the number of the population, a result is obtained which will not be correctly comparable with the result obtained by the same process in another district. In fact it leads to fallacious conclusions, for the localities compared may differ to a wide extent in their general death-rate. One locality may have its inhabitants dying from all causes at the annual rate of 30 per 1000, while another has its inhabitants dying at the rate of only 15 per 1000. Both might show a death-rate from Phthisis of 2 per 1000, an expression that would *per se* naturally convey the idea that the two districts were equally liable to the disease, a conclusion which is however quite erroneous, because in the district where there are alto-

gether 30 deaths per 1000 of the population only two of these arise from consumption; whereas in the district with only 15 deaths per 1000 of the population, there are actually 4 deaths from consumption out of every 30, which is just double the former ratio.

The only way in which these errors can be avoided, if comparing at all with the population, is to have the death-rate adjusted to a common standard, and the deaths from consumption in each locality raised or depressed accordingly.

Under these circumstances, for the present I have preferred to compare the deaths from Phthisis with the deaths from all causes, and worked out the results in per centages. Living in Aberdeen it was impossible to make these researches from the books in the Registrar-General's Office at Edinburgh; other means had therefore to be adopted to gain the necessary information. It could only be obtained by putting myself into communication with the numerous registrars in the North of Scotland, and inducing them to fill up a printed form supplied to them, noting down in the several years all those cases marked in their books Phthisis, or pulmonary consumption, as the cause of death. When the object of the research was explained to the registrars, the majority of whom are schoolmasters, they co-operated most readily with me, supplying me with all the required data, and giving a good deal of additional local information; a large number went so far as to give the ages, and in a parallel column the number of deaths from bronchitis and inflammation of the lungs.

I now avail myself of the opportunity to express my thanks to them for their kind co-operation and assistance. It has been to them an undertaking which has involved a large amount of labour and search through the books. We are therefore indebted to them for these statistics which extend over a period of 22 years, from 1861 to 1882 inclusive, and include no less than 322 separate registration districts.

At this stage of the investigation it will be enough to put down the leading facts elicited by the elaboration of the statistics, and the general conclusions to be drawn from them.

The eleven northern counties of Scotland to which I have confined my researches, although occupying an area of 14,493 square miles, the whole of Scotland being 29,819·8 square miles, are very sparsely populated, and according to the census of 1881 only contain 708,090 inhabitants, out of 3,735,573 in Scotland, so that, though the registration districts dealt with cover nearly half of Scotland, they contain only about one-fifth part of the inhabitants. The whole area may be said to be rural, for excepting Aberdeen with a population of 110,000,

and Inverness with 22,000, there are no large towns in it. It is also a part of country well adapted for an inquiry into the climatic influences on such a disease as Phthisis, for by its situation and physical geopraphy it presents great points of difference. There is, on the one hand, a large inland tract, some portions of which are elevated between 1,500 and 3,000 feet above the level of the sea. On the other hand, there are the low lying districts of the sea coast facing east, north, and west exposed to the various winds. The east side has its shores washed by the comparatively narrow German ocean, and has a moderate rainfall.

The west side washed by the broad Atlantic has an excessive rainfall.

The centrally situated high mountainous districts have in winter a large snowfall and intense cold. It is evident that between these elevated lands in the centre, and low-lying grounds on the sea coast, there is room for great variety in climate.

In the North of Scotland, not including parishes from which I have not received any returns, during the 22 years there have been 244,483 deaths from all causes, equal to the annual rate of 16·92 per 1,000 of the mean population, of these 24,259 have been from Phthisis, or 1·680 per 1,000, being nearly in the proportion of 1 death from Phthisis in 10, or more correctly, 9·92 per cent. of the total deaths. Excluding the City of Aberdeen, where during the last ten years, there has been an almost continuous decline of Phthisis, probably due to sanitary operations, the deaths from Phthisis in the Northern Counties vary considerably, thus they rise to 11·33 per cent. of the total deaths in 1870, the worst year in the period. The individual years vary considerably, thus the deaths from Phthisis rise to 11·33 per cent. of the total deaths, in 1870, which was the worst year in the period, and decline to 8·50 per cent. in 1874, which was the best year.

The totals for the different counties are given in a Table on page 98.

It will be seen that the mortality from Phthisis delineated on the accompanying chart, after declining in the years previous to 1864, continues to rise until 1870, after which it comes down every year until 1874, when it again assumes an upward tendency, but never reaches so high, as in the former eleven years. Comparing the first eleven years with the second eleven, there is a decided decrease. The average of the first eleven years is 9·97 per cent. of the total deaths, or 1·599 per 1,000 of the population; while that of the second eleven years is 9·22 per cent., or 1·455 per 1,000 of the population. A decrease of ·75

per cent., which, when stated in this way, appears to be but a trifling decrease; but ·75 per cent. represents an actual lessening of the deaths from Phthisis by more than 800 in the eleven years. There has also been a decrease in the general mortality from all causes. In the first period of eleven years, the average mortality was annually 16·03 per 1,000 of the population, in the second it was 15·80 per 1,000 This rate of decrease, however, is not nearly to the same extent as the rate of decrease in Phthisis. If the rate of decrease from all causes was represented as 1, the rate for Phthisis would be 17.

Diagram showing the proportionate mortality of Phthisis to the total deaths for the eleven Northern Counties of Scotland, from 1861 *to* 1882. *The Statistics for the town of Aberdeen are not included.*

The following are the figures from which the diagram has been prepared:—

1861.—10·25	1869.—10·30	1877.—9·40
1862.—10·10	1870.—11·33	1878.—9·25
1863.— 9·25	1871.—10·50	1879.—9·60
1864.— 8·77	1872.—10·11	1880.—9·30
1865.— 9·35	1873.— 9·57	1881.—8·70
1866.— 9·60	1874.— 8·50	1882.—9·50
1867.—10.35	1875.— 8·60	
1868.—10·15	1876.— 9·05	

Taking the actual numbers there were 99,581 deaths from all causes in the first period, and 99,102 in the second, being a decrease of 479 deaths, although the population was larger; but there was in the same period a decrease of 808 deaths from Phthisis alone.

As previously mentioned, the average deaths from Phthisis for the North of Scotland was 9·92 per cent. of the total mortality.

Examining the counties, we find that some arrange themselves above and some below that average.

Including the towns those above the average are:

	Per cent. of Total deaths.		Per 1000 of Population adjusted to the varying death-rates.
Elgin	11·03 ...	or ...	1·899
Shetland	10·66 ...	„ ...	1·805
Sutherland	10·63 ...	„ ...	1·800
Orkney.....	10·40 ...	„ ...	1·760
Aberdeen	10·26 ...	„ ...	1·736

Those counties below the average are:

Caithness	9·70 ...	„ ...	1·663
Banff	9·60 ...	„ ...	1·625
Inverness.....	9·48 ...	„ ...	1·605
Nairn	9·34 ...	„ ...	1·582
Kincardine	9·25 ...	„ ...	1·566
Ross and Cromarty.....	8·66 ...	„ ...	1·467

excluding in the several counties such towns as possess over 10,000 inhabitants, such as Aberdeen, Peterhead, Inverness, Elgin, Stornoway, and Wick. The counties arrange themselves somewhat differently.

Those above the average are:

	Per cent. of Total deaths.		Per 1000 of Population adjusted to the varying death-rates.
Shetland	10·66 ...	or ...	1·805
Sutherland	10·63 ...	„ ...	1·800
Elgin	10·61 ...	„ ...	1·800
Orkney	10·40 ...	„ ...	1·760
Caithness	10·31 ...	„ ...	1·747

Those below the average are:

Banff	9·60 ...	„ ...	1·625
Aberdeen.....	9·37 ...	„ ...	1·585
Nairn	9·34 ...	„ ...	1·582
Kincardine	9·25 ...	„ ...	1·566
Inverness	9·17 ...	„ ...	1·553
Ross and Cromarty.....	9·03 ...	„ ...	1·528

The range of difference in the percentages in the counties is not great. Elgin or Moray has the worst position with 11·03 per cent., Ross and Cromarty has the best with 8·66 per cent.

During the last eleven years the deaths from Phthisis de-

crease in eight counties, remain stationary in one county, and slightly increase in two counties.

Those counties where a decrease takes place are:

	Per cent. of Total deaths.		Per 1000 of Population adjusted to the varying death-rates.
Nairn	2·68 ...	or ...	0·660
Sutherland	2·29 ...	„ ...	0·387
Orkney	2·28 ...	„ ...	0·387
Shetland	2·01 ...	„ ...	0·340
Banff	1·18 ...	„ ...	0·199
Aberdeen	1·07 ...	„ ...	0·180
Kincardine	1·05 ...	„ ...	0·177
Elgin	·66 ...	„ ...	0·099

Inverness remains stationary.

Those that increase are:

	Per cent. of Total deaths.		Per 1000 of Population adjusted to the varying death-rates.
Caithness	·59 ...	or ...	0·236
Ross and Cromarty.....	·20 ...	„ ...	0·033

The continuous decline of Phthisis from the year 1870 until 1874 is remarkable, more especially that it occurs in all the counties.

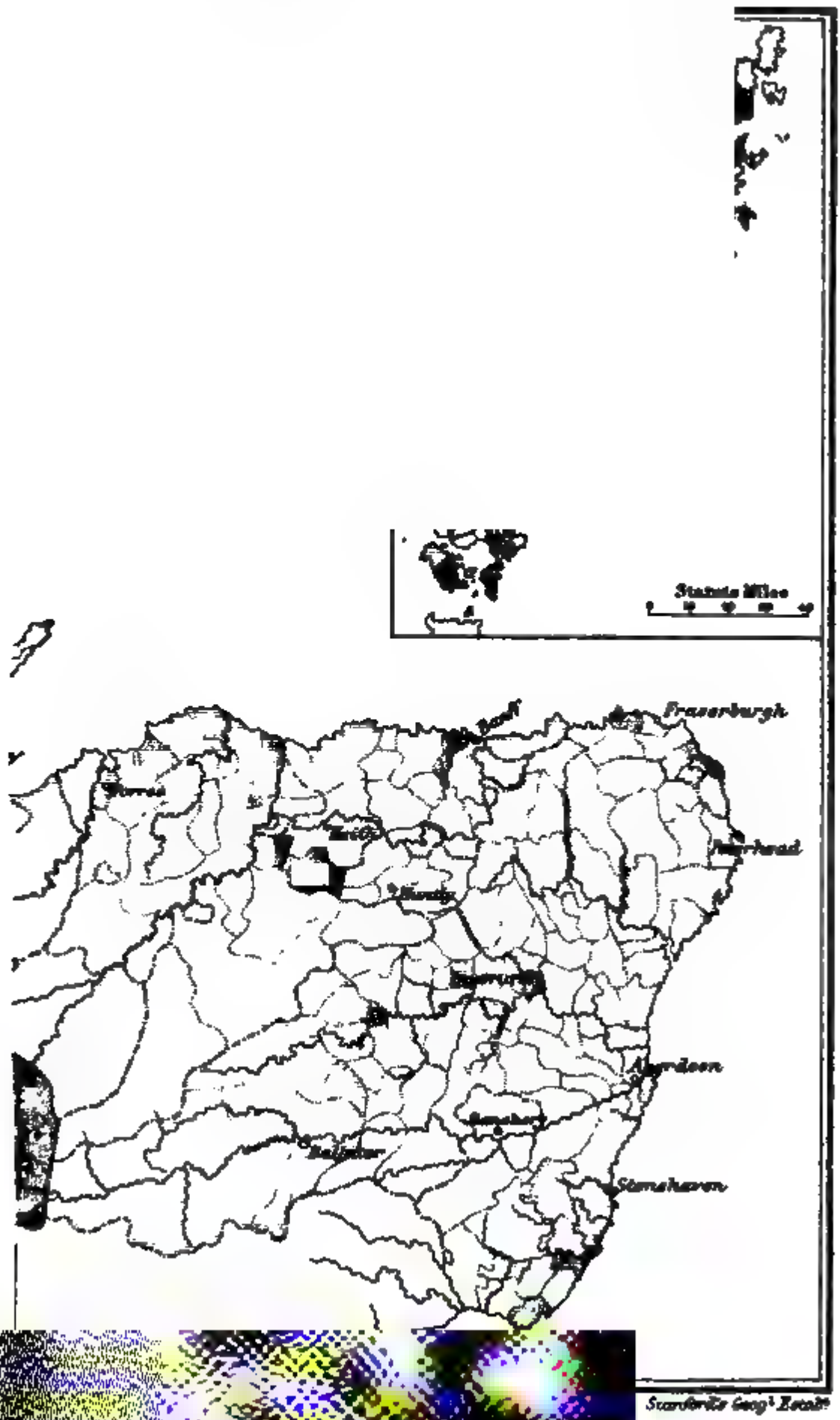
Though there is a certain uniformity about the counties when taken as a whole, and they do not show a great range of difference in their liability to Phthisis, yet, when the component parts or registration districts of each county are examined, they present an unexpected variety. Side by side lie parishes or districts that contrast, to an extreme degree, in their prevalence of Phthisis, or what may be called their productiveness of that disease.

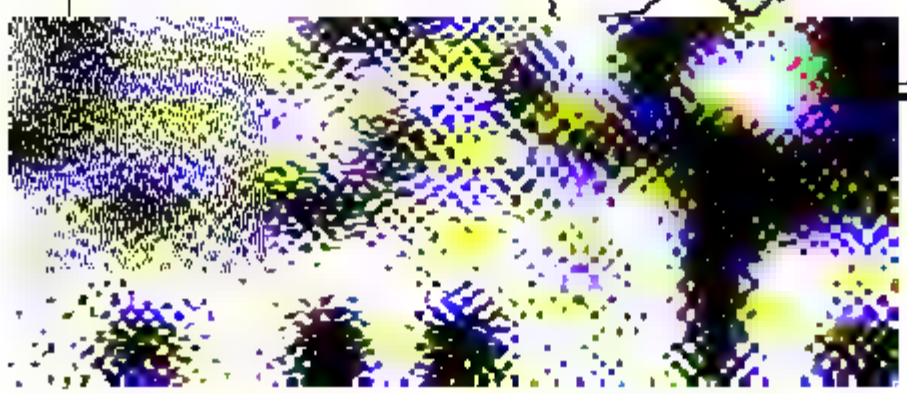
The map shows the proportionate distribution of the disease in the different districts. The blue colour indicates the districts above the average, the deeper the blue the worse is the district.

The carmine colour indicates the districts below the average, the deeper the red the better is the district. The deep blue and heavy carmine stand at the two extremes. The colours of lesser depth approach one another until the light blue represents just above the average, and the light carmine just below the average. The blank spaces, or those not coloured, denote parishes from which no returns have been received.

One of the most noticeable features in the map is the deep blue appearance of the north-west coast. The ridge forming

HE DIFFERENT PARISHES IN THE NORTH OF SCOTLAND.





the water-shed divides the land into two portions, the one sloping to the west and north-west, and the other sloping to the east. This water-shed appears to have an intimate relation with the prevalence of Phthisis, because for the most part it gives a distinct character to the districts on each of its sides.

That part of the country on the west of the water-shed has a high percentage of deaths from Phthisis, that on the east side has a comparatively low percentage.

The peculiarly unfavourable character of the north-west coast cannot be attributed to its proximity to the sea, for both north-east and north-west share this alike. Rainfall may have some influence, but not of itself, for in those localities further south, on the west coast, where the rainfall is even greater than on the north-west, Phthisis does not prevail to so great an extent, but the excessive rainfall combined with the cold north and north-west wind, producing a cold damp climate, may have an important share in the production of Phthisis. There are, however, apart from these unfavourable climatic conditions, local circumstances which may even have a greater influence. They are—poor living, insufficiently warm clothing, hovels of dwellings, and last, but not least, close intermarriage. Coming to the east coast it does not as a whole suffer much from Phthisis; the majority of its districts are below the average. On the coast of Kincardine and Aberdeen there is scarcely a break in its comparative freedom. The district of Kinneff and Catterline is below 5 per cent. A large number of the districts are below 7½ per cent., and there are only a few districts on the east coast above the average. With the exception of Tarbat, in Cromarty, there are none that have the deaths from Phthisis above 12 per cent. Even the average for the past twenty-two years of Aberdeen is only 11·03 per cent.; its worst average was during the first period of eleven years; during the last eleven years its average came down to 10·50. The easterly winds to which these parts are exposed are evidently not the producers of Phthisis to the extent for which they commonly get blamed; and the connection between catarrh and consumption is not so intimate as pathology might lead us to believe.

Directing our attention to the inland districts we find the approach to uniformity, which was noticed on the east coast, disappears. Localities where Phthisis is very prevalent border on others that are comparatively free. In Aberdeenshire the districts of Keig, Tullynessle, Forbes, Auchindoir, and Alford, which adjoin each other, are above the average, contrasting strongly with the neighbouring parishes of Monymonk, Tough, and Kildrumy, which are well below the average.

Along the northern bank of the river Dee, from its mouth

westwards to Ballater, and along both banks beyond Ballater, the districts are comparatively free from Phthisis. From Ballater, there is north of the Grampians a stretch of country, varying from fifteen to twenty miles in breadth, extending to Fort William on the west coast, which is very free from Phthisis. In the districts of Alves, Kingussie, and Insch which adjoin each other, and which are a part of this stretch of country, the deaths from Phthisis are under 5 per cent. For the most part, along the whole of the narrow tract from the German Ocean to the Atlantic, a sandy soil, resting generally on a gravelly basis, prevails along the banks of the Don, the districts with few exceptions are above the average. The districts on the north-west banks of the Spey, until the river reaches the highlands of Alves, Kingussie, and Insch, are above the average.

Then we have the parts along the Caledonian canal comparitively free. Amidst the glens of Inverness, Ross, and Cromarty Phthisis occurs only to a limited extent.

The famous watering place, Strathpeffer, shows a freedom far above the average, but this may be due to the very small number of inhabitants that reside there during the winter.

Tain and Dornoch enjoy in their sheltered positions a remarkable immunity. The horse-shoe shaped hills in Ross and Cromarty enclose valleys protected from the north-west wind. The valleys are moderately free from Phthisis, while the exposed parts have an excessive death-rate. Similarly, the strath of Helmsdale, protected from the north-west wind, with the best part of Caithness, all low lying, is comparatively free from consumption.

It is apparent that high altitude has no particular influence in the determining whether Phthisis shall be present or not in a locality. The parishes of Alves, Kingussie, and Insch are remarkable for their freedom from Phthisis; but there are neighbouring parishes at a similar elevation where Phthisis is very prevalent.

The Highlands do not in any particular degree enjoy a greater immunity in their liability to Phthisis than the sea coast on the east.

Now let us consider the Hebrides, and the question that presents itself to our minds for an answer, will be—Are they free from Consumption? Do they sustain the reputation for freedom from Phthisis, which they acquired ever since the writings of Mr. Morgan and Dr. Macrae. The answer must be no, they in no way deserve the reputation they enjoy, quite the reverse, for the islands show in large part a percentage above the average, and in some localities the percentage is very high. The only portions that are comparatively free, are South Uist and

Benbecula, in the Outer Hebrides and the district of Steat, which is one of the subdivisions of Skye.

There is one island that may be said to be free from Phthisis, it is St. Kilda. But this remote island has so small a population, and consequently so few deaths altogether, that the fact of Phthisis not being known there proves nothing.

The foregoing are simply the facts elicited by the research. The reasons for the differences in the districts cannot be ascertained with any degree of accuracy without a more lengthened and minute enquiry. Any hasty inferences would be worse than useless, but up till now the broad general facts brought out by the statistics enable us to sum them up as follows:—

I. That Phthisis has decreased in the North of Scotland during the last eleven years.
II. That Phthisis is more prevalent on the North-West coast of Scotland than on the North-East.
III. That the east wind is not productive of Phthisis.
IV. That the elevated portions of the country do not stand out prominently, even although they are more thinly populated, as being freer from Phthisis than the sea coast on the east, or other low-lying situations.
V. That the Hebrides are not free from Phthisis.
VI. That local conditions, whether they be social or geological, or both combined, appear to have a greater influence on the prevalence or non-prevalence of Phthisis than any general climatic agency.
VII. If there is any climatic influence, the north-west wind, combined with excessive rainfall, proves injurious.

Captain DOUGLAS GALTON, R.E., C.B., thought Dr. Simpson's paper did not appear to offer any very solid foundation for enabling them to judge of the prevalence of phthisis. He had brought out that in some districts phthisis was not so prevalent as in others adjoining offering the same conditions. Might it not be that the distribution of phthisis in different parts of the country was due to local conditions mainly, and it would be of great advantage if Dr. Simpson could find time before a future meeting to examine into the local conditions of the inhabitants of the several districts, and see whether these would not offer some clue to the distribution. As to Dr. Simpson's remarks regarding phthisis in the army, it was largely due to local conditions, and owing mainly to the improved condition of barracks and to the greater attention paid to clothing, diet, and to the effect of light duties, the disease had practically disappeared from the army.

Inspector-General LAWSON admitted that the improvement in barracks had contributed very much to the reduction of phthisis, but other causes had also contributed to this result. As to Dr. Simpson's statement that medical practitioners in this country sent their patients to the Mediterranean for the benefit of their health, while the military men there sent their patients home to England, he was under a mistake in assuming that the latter were sent home for the benefit of their health. The reason why the men were sent home was much more on account of their unfitness for duty, and from the circumstance that they did not seem to improve out there.

Dr. M'VAIL, Kilmarnock, said that he had been very much struck with the prevalence of phthisis and tubercular disease in the town in which he practised. He found they enjoyed the bad pre-eminence of having the very largest tubercular death-rate. In 100 deaths there were 20 from tubercular disease, and of these over 15 from phthisis. In endeavouring to get at the causes of this large ratio, and making a selection of these, he found one stand out pre-eminently. The food of the people, although not too good, was not worse than in other places. Then, in the town there was a very large number of houses of only one apartment, but not a greater proportion than in Glagow and other towns. There was, however, one other thing —the condition of the soil, which was chiefly composed of clay, and was retentive of damp. Kilmarnock lay in a very low level; it was surrounded on all sides but one by hills; the rainfall was heavy; the prevailing winds were south-westerly and westerly, and the consequence of this was, that while their phthisis rate was very high, the rate from inflammatory respiratory diseases was very low. He did not think that the large phthisis rate was due to that disease being written down in cases in which the disease was really bronchitis, because some other towns in the south-west corresponded with Kilmarnock in having a low bronchitis death-rate. These factors seemed to him to bear out pretty much what Dr. George Buchanan had discovered in regard to the prevalence of phthisis in some counties in England. It was important that they should recognise the fact that in different circumstances phthisis might have very different causes. Probably the most important truth was this—that tubercular diseases were thoroughly within the domain of sanitation, and that they had as much right to be included in the province of the medical officer of health as zymotic diseases had.

MR. G. J. SYMONS, F R.S., London, considered that the real secret of the difference in the prevalence of phthisis in particular districts would be elicited by individualising facts more thoroughly than had yet been done. He was inclined to think it was more likely to be a question of subsoil than the author supposed. He further thought that a great deal depended upon the geology of a district, and if they had had the geological map of the north of Scotland in connection with the map exhibited by Dr. Simpson, it would have thrown

considerable light upon the subject. He had great pleasure in proposing a vote of thanks to Dr. Simpson.

Dr. A. CARPENTER said the paper directed attention to several points of considerable importance; but they must not lose sight of the fact that it was in a great measure after all an inquiry into the antecedents of the individual case that would give them the information they wanted. For instance, it was proved on all hands that a damp sub-soil tended to promote phthisis, but that was only a small part of the case. There was a tendency on the part of inhabitants in those exposed regions to crowd together for warmth and dryness, a practice which conduced to the growth of phthisis, by encouraging the manufacture of impure air, and then there was the hereditary tendency in a family where phthisis was so much more easily brought out in life than in those free from it. He expressed the opinion that phthisis was a disease which was preventable, and that it came within the province of the Institute, as much as fever or any other infectious disease that was dependent upon outside influence. Dr. Simpson's paper directed attention to several points that were of considerable importance, but they must not lose sight of the fact that it was in a great measure inquiry into the stock and into the antecedents of the individual case that would give them the information they desired. He had pleasure in seconding the motion.

Professor GAIRDNER believed the north-east and east winds had much less to do with phthisis than was commonly supposed to be the case. He regarded the important paper now read, and the map which accompanied it, not as settled information, but as materials for future information. Dr. Simpson should simply make the paper the initiative for future inquiries. He should carry on his investigation particularly in regard to certain districts which looked paradoxical or extreme, and so be enabled to give his information more in detail. One fallacy which ought to be kept in view was the various names by which phthisis was known in different localities, while another influence very subversive of accuracy on this point was the tendency of insurance societies in districts where their business extended to create an indisposition to the use of the word "phthisis," in registering the cause of death. Without in the least degree attributing any improper motives to anybody, he would say, the ordinary influences of human nature tended to make phthisis appear less frequent than it was. All these fallacies had got to be discounted, as it were, in any research on this subject. He would entreat Dr. Simpson, in future enquiries, not to keep in view phthisis alone, but all the diseases of the chest, and their comparative death-rates, and also forms of diseases notably and largely tubercular, although not necessarily called so, particularly the nervous diseases of children, besides scrofulous and other diseases. He did not believe in winds doing much injury, but he did believe to an enormous extent in domestic conditions as a cause of phthisis.

Dr. SIMPSON briefly replied,

COUNTY.	Mean of Population 1861 & 18 Balance	tal Deaths during the 22 years. Balances. 1 m all ses.	2 From Phthisis.	Percentage of Deaths from Phthisis to Total Deaths Balances.			Death Rate from Phthisis when adjusted for General Death Rate.	Actual Total Deaths during 22 years. 1 From all Causes.	2 From Phthisis.
I. Northern Division.									
1. Shetland	21681	147	762	10·66	14·96	1·599	+1·805	10401	
2. Orkney	32202	567	1099	10·40	14·91	1·551	+1·760	10567	1099
3. Caithness.....	40912	783	1434	9·70	16·42	1·614	−1·663	14783	1434
4. Sutherland	20068	150	750	10·63	15·96	1·699	* +1·800	8004	
II. North-Western Division.									
5. Ross and Cromarty	75011	27	2351	8·66	16·43	1·425	−1·467	29418	
6. Inverness	77814	34	2302	9·48	17·25	1·637	−1·605	32302	
III. North-Eastern Division.									
7. Nairn	8622	13	319	9·34	17·99	1·682	.....	3413	319
8. Elgin or Moray	44746	63	1870	11·03	17·22	1·899	+1·865	16953	1870
9. Banff	56152	21	1950	9·60	16·45	1·580	−1·625	21040	
10. Aberdeen.....	244039	54	9778	10·26	17·74	1·821	+1·736	96659	
11. Kincardine	35157	34	1142	9·25	15·94	1·476	−1·566	12334	1142

* Balances implies that a proportionate reduction has been made for those places from which returns have not been received.

On "Cholera Epidemics: their Etiology, Modes of Diffusion, and Preventive Measures, with Special reference to Quarantine," by J. CHRISTIE, M.D.

ETIOLOGY.—At the International Sanitary Congress, held at Vienna, in July, 1874, it was unanimously affirmed that "Asiatic Cholera, susceptible of spreading epidemically, is spontaneously developed in India, and when it breaks out in other countries it has always been introduced from without. It is not endemic in any other country but India." To these propositions I cannot assent; for it is impossible to say more than that cholera is endemic in India, just as we say that enteric fever is endemic in this country. We, as yet, know nothing regarding the origin of the disease; nor can we say, in any case, that it originates spontaneously or *de novo*, though there is no reason why we should conclude that it never originates *de novo*. What happened once, when the first cases appeared, may, under similar combinations of circumstances, happen again; but what combination of circumstances would certainly, or even probably, give rise to cases of cholera we have no conception of. There is certainly nothing in the manners and customs of the inhabitants of India, nor in the climate thereof, as distinguished from the manners and customs of the inabitants of other tropical countries, that can give us any clue to the etiology, or the intimate pathology of cholera.

Medical men who have made this subject a special study, both in this country and in India, maintain views diametrically opposed to each other, as to the genesis of cholera, some affirming that the disease depends upon the presence of specific germs, or micro-organisms, which, having gained access to the human body, multiply to an enormous extent there, giving rise to the various phenomena of the disease; while others, to use the language of Sir Joseph Fayrer, "admit the existence of a poison of some sort—a miasm or an influence, though of its nature they are ignorant. It is a subtle thing that travels in certain directions in obedience to certain laws, is influenced by atmospheric and telluric conditions, and where it goes and finds certain local conditions, and people prepared by them to submit to it, there cholera will prevail. They deny the efficacy of any enteric or specific poison in the water to produce it, though they attach the greatest importance to the purity of water from

all organic contamination, impure water being one of the local conditions which, if added to crowding, filth, or other insanitary conditions and want of proper ventilation, is that, of all others, which favours cholera." The germ theory is that which finds most favour with epidemiologists in this country, while the latter is that most generally accepted by those in India, though many in India give their adherence to the germ theory,

The question is by no means settled yet, but we may reasonably expect that important advances towards its solution will shortly be made by the scientific commissions which have been sent to Egypt to investigate the etiology of the recent outbreak of cholera there. The chief interest will centre on the investigations of M. Pasteur and his colleagues as to the existence of bacilli in the tissues or excreta of those suffering from the disease; but whether such micro-organisms be or be not discovered, our views regarding the modes of propagation will not be greatly altered or modified. The germ theory is within the province of scientific investigation; but the subtle miasm or influence that travels in certain directions in obedience to certain laws, and which is influenced by certain atmospheric and telluric conditions, is beyond the region of scientific research.

MODES OF DIFFUSION—In investigating the modes of diffusion, or propagation, of cholera, or of any other disease which is liable to become epidemic, we must commence our investigations at the sick, not at the dead. Our starting point must be at the bedside, not at the books of the Registrar; but if the statistics of the Registrar are to be utilized for any practical purposes, they can only serve as guides to the locality where the investigation must begin. The bare statement that as many deaths from cholera occur in Calcutta in the month of February, and that they gradually increase in number till April, and decrease till the end of May, a period of storms and showers, is of some interest as a statement of facts; but is of no value whatever either in respect to the etiology or the propagation of the disease. It has been affirmed, again and again, that cholera and enteric fever "may have different modes of working in India and in Europe"; but it is much more probable that the varying results obtained depend more on the different modes of investigation.

The most startling statement that I have read for many a day is contained in the 18th Report of Dr. Cuningham, Sanitary Commissioner with the Government of India, p. 127, when he says:—"The experience of fairs and other gatherings in this country (India) has, again and again, testified to the truth of the conclusion that cholera is not carried by persons

from one locality to another, so as to cause persons not themselves exposed to the necessary local influences to become affected by the disease. Coincidences certainly can be cited, in which the arrival of persons from a cholera-affected district has been closely followed by an outbreak of the disease; but even these coincidences are far fewer than is generally supposed." The statement of the highest sanitary official with the Government of India that cholera is not carried by persons from one locality to another so as to cause persons not themselves exposed to the necessary local influences to become affected by the disease, certainly demands explanation at the present juncture of affairs. What are the *necessary local influences?* From a careful perusal of the Report which has just been issued, I can form no conception as to what these *necessary local influences* are. If the disease be not transmissable by persons, I cannot imagine that it can be transmissable by any of the belongings of persons, such as clothing, or that it can be transmissable at all. If so, I, in conjunction with my late lamented friend, Mr. Netten Radcliffe, have been engaged in writing a work of fiction called a "History of Cholera Epidemics in East Africa."

That the views of Dr. Cuningham are not universally adopted in India is evident from a perusal of the eighteenth Report of Dr. Furnell, Sanitary Commissioner for Madras, dated 1882, which contains several cases of thoroughly-investigated outbreaks of cholera within the Presidency, more especially in connection with the great annual feast at Tirupaté.

The local conditions necessary for the diffusion or propagation of cholera are local conditions of filth, the more important of these being a local supply of portable water exposed to excremental pollution. I do not, by any means, hazard the statement that water polluted by the excreta of a cholera patient is the only mode of propagation, but I maintain that it is the chief, and that, in every case where great and sudden outbreaks have occurred, the *origo mali* has been traced to such polluted wells. In May, 1865, the number of pilgrims at Mecca was estimated at about 100,000; and during the celebration of the rites from 10,000 to 15,000 fell victims to the disease, two-thirds of the deaths having occurred during the six days over which the rites extended while the pilgrims were at Arafat and the Valley of Muna. Previous to the celebration of the rites each pilgrim, standing at the side of the well, has a bucket of the water poured over him, and he drinks as much of the water as he can, the water poured over him passing back into the well. In writing on this subject in 1876, I called attention to the fact that, if any of the pilgrims were at the time suffering from cholera, or had cholera-tainted garments about them, the well of Zem Zem

would certainly be poisoned, and that the fearful mortality would be accounted for. Within six days after these ablutions, and the drinking the water of the Zem Zem, the streets of Mecca and its mosques, the twelve miles of road lying between the city and Mount Arafat, the valley of Muna, and the plain of Arafat were cumbered with the dead. In 1881 Professor Frankland got a sample of the water for analysis, and he says: "I have analysed this water, and find it to be of the most abominable character. In fact, it is sewage, more than seven times as concentrated as London sewage, and it contains no less than 579 grains of solid matter per gallon. Knowing the composition of this water, and the mode of propagation of Asiatic cholera by excrementitious matters, it is not to be wondered at that outbreaks of this disease should often occur among pilgrims to Mecca, while it would scarcely be possible to provide a more effective means for the distribution of cholera poison throughout Mohammedan countries." Year after year pilgrims may drink of this water with immunity, but the introduction of the specific germs, or the *materies morbi* of cholera would certainly render it a virulent poison; for there is every reason to believe that such matter is propagated in a suitable medium outside the human body.

In 1869–70, during an epidemic of cholera, there died in the city of Zanzibar, at least 10,000 out of a population of about 100,000. Two sections of the community escaped not only death but sickness, those unaffected being the Europeans resident in the town, and the Banyan population, natives of India. A considerable number of Europeans on board ship in the harbour, were attacked, and there were several deaths. During the epidemic, the ships were anchored well out, and they were not exposed to any land breeze; for the north-east monsoon was blowing strongly at the time. The local influences, atmospheric and telluric, were common to all in the city, and the houses of Banyans who escaped were mixed up and identical with the houses of the other natives of India who were attacked. The Banyans, however, in accordance with their invariable custom, used the water of their own well, which was not exposed to excremental pollution, and to which none but their own caste have access; while the Europeans living on shore used either filtered rain-water, not exposed to pollution, or water of superior quality brought from a distance of four or five miles. With the exception of an unpolluted water supply, the Banyans and Europeans had nothing whatever in common. The other natives of the city used water drawn from the town wells, which were all exposed, more or less, to foecal contaminations through soakage; while the water supplied to the shipping was drawn from a stream liable to pollution, though the pollution could not be

constant. The immunity of these two sections, however, was not complete; for each had a single death from cholera. The European who died had been drinking water from polluted sources during a long journey from the country to the town; while the Banyan who died was in the old clothes line of business, and he had been dealing in the spoils of the dead. If there is one thing more than an other as to which I am thoroughly convinced, not even excepting my own existence, it is that cholera is conveyed by man to man, not necessarily, nor even usually immediately, but mediately through excretal matter.

Pandemic waves, air-borne influences, choleraic blasts, atmospheric and telluric conditions, subtle miasms and influences, the variations in the ground-water, neither singly nor combined can account for the geographical distribution of the great cholera epidemic which prevailed in Asia, Africa, and Europe from 1864 till 1872. With steady march, it passed along lines of human intercourse, attacking the inhabitants of cities and towns who were exposed to all sorts of insanitary conditions, and also tribes whose only protection from the weather was a bullock hide for a tent, and whose only article of dress was a coating of oil or fat. It prevailed among tribes whose exclusive diet was vegetable, and among others who ate only the flesh of the bullock. Those who ate fresh meat were as liable to attack as those who ate the flesh of animals in an advanced state of decomposition. The recent outbreak of cholera at Damietta was ascribed to the pollution of the Nile from the bodies of dead cattle having been thrown into it; but how this mode of pollution could originate cholera I cannot imagine. The Wanyamuezi do not bury their dead, and they delight in putrid animal food. I have myself seen crowds of them cutting up the body of a hippopotamus in such an advanced state of decomposition that I could not stand within a hundred yards to the windward of it. The Manyuema eat their own dead, but not until the bodies are semi-putrid, and they do so with apparent immunity. In consequence of such practices, cholera never originated in the Wanyamuezi, nor in the Manyuema countries; but it reached them in the usual mode.

PREVENTIVE MEASURES.—The worst mode of meeting an epidemic of cholera is to wait till it reaches us and then to fight it; but the best plan is to render an epidemic of cholera impossible. This can be done with comparative ease, the only difficulty being in moving Government and our Local Authorities. The public measures for the prevention of cholera are measures equally necessary for the promotion of public health, and, I may add, for the promotion of public morality. With a pure water-supply, uncontaminated between its source and distribution, a

great outbreak in a community would be impossible. With a reasonably careful mode of excretal disposal, the risks would be greatly lessened; while, with complete cleanliness all round, solitary cases only would occur. Cleanliness, in the sanitary sense of the term, does not mean a well-washed face, a clean shirt collar, front, and cuffs, or a thoroughly dusted house; but it means the immediate removal from our dwellings, and from our surroundings, of all decomposing matter, and the immediate destruction of it, by fire, after it has been removed. The main object should be the removal of all local insanitary conditions, so as to render the increase of the *materies morbi*, or of the micro-organisms, outside the body, impossible.

In this country considerable progress has been made, during recent years, in sanitary matters, but we are still far from being perfect. We see the beneficial effects of complete sanitary organisation in our cities and large towns; but there is urgent need for extension of similar operations in our small towns and rural districts.

The actual outbreak of epidemics can only be encountered by the management of first cases of illness—by the isolation of cases, and the absolute destruction of all excretal matter. The *cordon sanitaire* and *quarantine*, can only be applied with any reasonable prospect of success to the patient in the hospital and to the family in the reception house. In order to accomplish this, not only a registration of death, but a registration of illness must be compulsory. What is necessary in Europe, is equally necessary in India, the endemic seat of cholera; but while the difficulty in carrying out such measures in this country is great, the difficulties with the native populations of India are almost insuperable. In India a distinct sanitary service, on the model of that of England, is an urgent necessity, and the entrance to that service should not be through the portals of the Indian Army. It is quite impossible for district surgeons, whose chief duties consist in the administration of jails and hospitals, and who have to attend professionally on the government officials, and who, moreover, are engaged in private practice, to attend to the sanitary supervision of a large native population, spread over an immense district. So long as people are permitted to wash their cloths and bathe in tanks from which they draw their water supply, epidemics of cholera must inevitably break out; and the greater the number of the people attacked, the greater is the probability of epidemic being widely diffused. The really important international question as to cholera, consists in an investigation as to the sanitary service of nations.

QUARANTINE.—Quarantine, in order to be effective as a preventive measure, must be complete. Where, therefore, are we

to begin, and what is to be done to ensure immunity? Take Bombay, for example, or Calcutta. In the third week of April, 1883, there were 145 deaths from Cholera in Calcutta; and we may safely take for granted that there were at least 580 cases of the disease. Would such a rate of sickness and mortality render the measure of Quarantine necessary? If so, it would be necessary to blockade Calcutta by river and land until the epidemic disappeared. So, also, in regard to Bombay and all other parts of India. A sanitary question of International interest does not, or should not, be considered as affecting Europe alone. The only possible benefit that could result from a rigid system of Quarantine would be the touching of the public conscience, through the public purse. The interruptions to the commerce of India might stimulate sanitary research and sanitary reform in India, but nothing more. Egypt, and all other countries in an insanitary condition, will be swept by epidemics time after time; and it is quite proper that such should be the case. The sanitary system of the universe is perfect; and it is ever true that "the soul that sinneth it shall die." There is no certain specific for Cholera, and it is to be hoped that none will ever be discovered. Neither is there any specific, such as Quarantine, for epidemics of Cholera in any country. The only mode of protection against Cholera is to render its propagatives in a country impossible. To send sanitary experts from India to Egypt, in the recent crisis, has much the appearance of the comedy after the tragedy.

Professor F. DE CHAUMONT, M.D., F.R.S., said the statements which had been made that the recent outbreak of cholera in Egypt could in no way be traced to cases of sickness from India were quite right. The opinion had been expressed by Pettenkofer that cholera was brought from India last year by the troops belonging to the Indian army, and that the germs left by them found in Egypt a favourable field for their development. That was possible. On the other hand it had been said that the disease arose spontaneously, no special disease germ being necessary. He did not hold these views at all. With regard to the question of quarantine, it had been admitted that cholera germs were capable of being carried from place to place by human intercourse, but he held that quarantine regulations were absolutely useless as well as impracticable. These regulations interrupted business and delayed travellers without doing any good whatever. A very interesting speech was made at the recent congress at Amsterdam by a shipowner, in which the speaker pointed out the many difficulties which shipowners had to contend with, including those created by quarantine

regulations. That shipowner said it was perfectly easy in any port of the world to get quit of the annoyance caused by quarantine regulations by the payment of "bucksheesh." During the recent outbreak of cholera in Egypt, a sanitary cordon was drawn around Alexandria for the purpose of preventing trains, carrying for the most part cleanly persons, from entering the city, yet filthy Arabs were going about on foot, carrying the disease into the place. They were still in the dark on the subject of the spontaneous origin of typhoid fever and he did not believe in it himself, but great weight of evidence went to show that mere sewage did not give rise to the disease. There were many instances of people for twenty or thirty years drinking from polluted streams without their being attacked by the fever. They could only account for the spread of the disease by the fact that the poison, when once it found conditions favourable for its propagation, spread among the populace. It was, however, a happy thing that whatever views were held, all were agreed that sanitation was the fundamental point they ought to aim at, instead of futile attempts at quarantine and sanitary cordons. The drinking of impure water was favourable to the disease, but the best preventive was the removal of sewage from large centres, proper ventilation, and attention to personal cleanliness.

Mr. Jones, Madras, said he was in Madras during the last visitation of cholera. He noticed that the persons principally affected were the washermen, which showed that cholera was carried about by the clothing as well as by the person. It had also been noticed that the disease usually commenced in the north-west of India, and came down to the south-east with the pilgrims. Although these pilgrims might not be personally affected, they still carried the disease to the places they visited, and left it there. With regard to typhoid fever, they employed in Madras about 800 men in cleansing the drains, and he had never known of any of them being affected with typhoid fever. This showed that sewage had no effect with regard to the introduction of typhoid fever.

Mr. T. Harnett Harrisson, Liverpool, believed it was Dr. Snow who, in 1849, first traced clearly the spread of cholera to impure water, and from that time till 1855 a great deal of evidence was given in that direction which was collected and published by Dr. Snow. It had been proved that towns which had secured a supply of pure water escaped cholera to a large extent. The same towns having been severely visited during previous epidemics when their water supply was bad. Dirt might be regarded as the home of cholera, temporary or otherwise. The one thing needful for its spread and propagation seemed to be dirt, whether it be dirt in man, air, earth, water, or perhaps food. Perhaps its chief means of conveyance was dirt. Its line of travel was the line of travel of dirty Easterns. The fairs in India, where immense numbers of dirty people congregated and remained for some time without any sanitary pro-

visions were the most likely places to which it would be conveyed, finding a new home and a new centre for redistribution. It seemed to be conveyed by dirty men to dirty places. He believed those who had the nursing of cholera patients, and who lived in an atmosphere arising from the profuse dejections from their bodies escaped in a wonderful way, probably because they took care that their bodies should not be dirty homes for disease.

The provisions necessary for the prevention of cholera seemed to be pretty much the same as those required for other epidemic diseases, namely cleanliness—clean men, air, earth, and water.

A friend, who was in Egypt during the recent epidemic there, told him that he had known the body of an Arab, who had died from the disease, to be dug up by his friends for the sake of the blanket that enveloped it.

Dr. KIRKWOOD, Largs, referred to his experience as regards cholera at Gartnavel Asylum in 1848 and 1854. The patients in the second period were warmly clad, the diet changed—the food being better, and of a nature which would not affect the bowels. They refused to admit patients altogether, so as to avoid anything like overcrowding, the house being pretty full at the time. Special attention was given to the clothing and bedding of the patients, and the dietary was altered. Nightly visitations to the domitories were made, and the ventilation and temperature noted. The precautions taken were found to be so effectual, that in 1848 there were 40 deaths, and in 1854 only 4. At neither period was there a case in the West house where private patients were lodged, all the cases being in the East Wing, which was the more general hospital.

Inspector-General LAWSON held that we should be more precise in ascertaining our facts. We had got stock notions in this country, and did not alter them according to the evidence which reached us. A great deal of evidence was so mixed up with circumstances non-essential to the case that they proved neither one position nor another. Dr. Christie had alluded to the well at Mecca, which he was under the impression became soiled by the discharges of cholera patients, and thus there was a great development of cholera. He also said that the water from this well showed when analysed a quantity of foreign matter seven times in excess of London sewage. Now, it was a well-known fact in India that water containing a saline purgative would excite cholera when the tendency to that form of disease existed. As to the communication of cholera from man to man, he mentioned that in 1873 there was an epidemic of cholera in America. It started in New Orleans in February, and spread up through the valley of the Mississippi. It was regarded as Asiatic cholera, but was not preceded by the arrival of any person affected with the disease. It was supposed to be imported from Europe, in three instances in August, but on examination the evidence in each of these broke down, and certain cases appeared in New York;

but in no case did the disease spread along the coast during that year. Then in 1865 there were a number of cases at Southampton, and at Hingdon Bois, in Essex, but the evidence as to its importation was altogether wanting. With these and other facts before us, it must be admitted that cholera might arise in a locality without any personal communication whatever.

On "Typhoid Fever, its Origin and Prevention," by J. FRANCIS SUTHERLAND, M.D., Edin.

GENTLEMEN—I know of no subject which could have a greater claim upon the attention of sanitary reformers than the origin and prevention of typhoid fever. In the scope of a paper such as this I can only hope to touch the fringe of this great public question. The settlement of the etiology of the disease rests entirely with the physician and biologist of the future: the hygienic measures necessary to check its ravages, nay, even to extirpate it, belong to the medical officer of health, to the sanitary engineer, and to all who are interested in promoting the public health. As it is a disease which meets every medical man as he enters the portal of his life's work, I am here, with your permission, to express the thoughts and convictions which I entertain after several years of experience of outbreaks of this disease under widely different circumstances. I trust at this time I may be enabled to say something that may lead to the advancement of our knowledge regarding it, and may suggest useful hints to the general public who are interested in our proceedings, and who will not fail to take cognizance of the utterances that may be given forth regarding a malady which is yearly executing so much havoc in out midst. Let me endeavour to show in a few simple words—I say simple, because I have ever thought that problems fraught with so much interest to the people should be couched in language free from technicalities—the claims which typhoid fever has upon sanitary corporations and individuals. It is one of the most common of the serious ailments of civilized life. It is never out of our midst. No household at present is safe against it. I suppose I am within the mark when I say that there is scarcely a family but has felt its blighting influence. Rich and poor alike pay heavy tribute. It stands seventh as to the number of its victims on the mortality roll of this country. Within the last

twenty years in England alone, 200,000 lives have been sacrificed to it, and what is saddest of all, it makes its principal onslaught upon men and women in the prime of life, that is to say, between 15 and 30. That being the case, our modern armies pay a tribute five times greater than the civil population. While it is reckoned that from 2 to 10 per 10,000 of the civil population perish from it 10 to 30 of the military. On the Continent matters are even worse than at home. For the last eight years Paris has suffered from its ravages far beyond any city in Great Britain, no less than 1,000 per 1,000,000 of the population having succumbed to it in 1880. In St. Petersburgh the mortality is still higher, being at the rate of 1,500 per 1,000,000. But this sad picture would be incomplete were I to stop here, for every life which it destroys, ten at least have passed through the long and wearisome illness with which many of us are so familiar.

With these prefatory remarks I approach the etiology of the disease. The present is an opportune time for discussing it, whether we look at the question from the interest which should centre round itself, or from the fact that an allied disease, cholera—allied at least in the *modus propagandi*—is working havoc in Egypt, and may be introduced at any moment to our shores. Not only are they allied in so far as the spead of both is intimately associated with the bowel discharges, but also because they are both essentially filth-diseases. While medical men and sanitary reformers have been doing something towards a settlement of other diseases, we have been content to leave the mode of origin of typhoid fever, where Murchison, the most eminent authority on the continued fevers of this country—left it ten years ago. As far as I am able to judge, we are no nearer a solution now than then. In this country and in France two theories are held regarding the origin of the disease. One is that there exists a specific contagion or germ which passes from the patient only in the intestinal discharges. This germ is a living organism which seems to be harmless at the time it is expelled from the sick person's body, but in a few days under certain conditions, multiplies and acquires a virulent vitality. The gas rising up from sewers and privies often conveys the contagion into our houses, or it may reach us by drinking water polluted with sewage containing the typhoid germ: when it then is swallowed or inhaled by a suitable subject for infection it originates enteric fever in him. Budd, of Bristol, whose name will always be identified with this theory, by his facts, and by his reasoning on these facts, has forcibly argued, that it is only the sewers and cesspools which have received typhoid fever stools, which contain the typhoid germ. The great majority of investi-

gators incline to this view. Among many eminent names I may mention those of Parkes, of Gueneau de Mussy, Pasteur, Jaccond, Cormack, Maclagan, and Corfield. The other theory will always be associated with the illustrious name of Charles Murchison. He believed that the disease originated independently of an anterior case by the decomposition of fæcal matter. In other words he showed that it was a filth-disease which arose independently of the disease which it generated. It was Murchison who proclaimed the spontaneous generation of the disease. Its supporters now include the names of Carpenter, Brouardel, Jenner, and Colin, the eminent professor at Vâl-de-Grâce. Chauffard, Trousseau, and many others believed and testified that it might arise in both ways. Trousseau's words are of immense value. He stated that "as it is frequently impossible, notwithstanding the most painstaking researches to discover the origin of the contagion, and as it is obvious that typhoid fever at some time or other had a beginning, we cannot refuse to admit the possibility of its arising spontaneously."

I wish it clearly to be understood that the great point in the contention of Murchison and others is that it was not necessary that typhoid stools should have reached and mingled with the sewage which contaminated the air we breathe, or the water we drink. Ordinary fæcal matter—filth—was quite capable of doing the mischief. With this view of the question I entirely agree. I cannot, however, believe in the spontaneous generation of germs. It must be conceded that all the phenomena of so-called spontaneons generation yet observed are to be explained by the presence of living germs in the air, and that Redi's dictum, *omne vivum ex vivo*, still remains uncontroverted. Thus far I am at one with those who believe that typhoid may originate from sewage *per se;* but I go much further and maintain that no specific germ is necessary for the production of this disease.

Let me explain how I have arrived at this conclusion; and in doing so permit me to say that although I hold such decided views, yet I entertain the most profound respect for the views of the eminent men who think otherwise. I have tried to reconcile my experience with the two theories most commonly entertained, but have failed. The supporters of the specific origin believe that the disease is due to a specific germ, or minute living organism which microscopists with powerful lenses may yet be able to demonstrate in the blood or intestinal glands of typhoid patients, and which biologists may yet be able to cultivate and reduce to a state of comparative innocuousness. This is a pleasing prospect, but I am by no means sanguine we shall see it, hopeful, rather in the belief that, as it arises from the

germs of fæcal pollution, it will be as thoroughly eradicated from our midst as the black plague of the Middle Ages. But if the view is to be maintained that entirely (for there are many sanitarians who support that theory) or in great measure, that typhoid fever can only arise from its specific predecessor, whose genealogical history sanitary science has failed to trace, then all we can hope for is to minimise by cultivation of the poison, or, what I prefer, by a system of personal, domestic, and public hygiene, the disastrous effects of this as of any other social scourge.

The memories of cholera which, during its last visit to our shores in 1848-49, carried off 80,000, sends a thrill through the country, and yet from typhoid alone 13,000 have died on an average during the last 20 years, or from the combined diseases so intimately associated with filth, 20,000, and little is really heard or said about it. The theory that typhoid is only begotton of typhoid—in other words, that it must have a lineal descent—reminds one very forcibly of another fashionable theory where the connecting link to prove it, was wanting. It is really matter for surprise if one and the same disease can be created by means so diametrically opposite as the specific germ known as the *bacillus typhosus*, and the non-specific germ of filth. Either the one or other must be true? Until the typhoid germ has been demonstrated, and experiments made on the lower animals free from the fallacies which surround those already made, I must abide by the belief that it is due to a non-specific germ, which I may be allowed to designate the *sewage per se* germ. This germ or microbe has also a history. It is admitted that ordinary fæcal matter which passes throuh sewers, or remains in stagnant cesspools undergoes fermentation and decomposition, not only by the action of ammoniacal urine, but also by the action of the atmosphere itself. Chemical changes take place: living organisms are produced in great abundance—call them by what name you choose. Whether the living organisms, which are the cause of typhoid, found in the bowel discharges were originally there, and have in the course of decomposition altered their character and multiplied, or whether they are atmospheric germs which have gained access to the sewage, and in this new medium changed their character, is immaterial. These germs abound in sewers, cesspools, and privies. They reach our bodies by the air we breathe or the water we drink. I make no mention of milk, as it is now an established fact that poison germs gain access to this fluid in dairies where the vessels are washed, or the milk diluted by the poison-charged water. In the human system they find a medium in which not only do they multiply, but become virulent and produce those well

marked clinical symptoms so characteristic of typhoid fever. After having done their work, and played themselves out, if I may be allowed to use the expression, they are expelled from the body by the bowel in a different, and to all appearances an innocuous form. The harmlessness of the expelled germ is attested by the highest authorities. Let the bowel discharges of a tyhoid patient, however, gain access to a medium where fermentation and decomposition will rapidly ensue, and then by inhaling or swallowing the poison the disease is again established.

If other proof is wanted of the harmlessness of the fresh evacuations it is to be found in the recorded statement that 5,144 patients were treated in general wards with 3,555 cases of enteric fever, and none took the disease. I am prepared, however, to admit that typhoid evacuations are nearer that state of decomposition when they become dangerous, than the ordinary bowel discharges. But in both instances chemical changes and the air laden with its own freight of organised matter, set up fermentation and decomposition. In the one the germs, although abundant, are innocuous: in the other they have lost their power only to regain it more rapidly. As Murchison puts it, the history of many epidemics in country districts, of isolated cases confined to single houses, prove that it is often impossible to attribute the first appearance of the disease to contagion. He says, "it is not uncommon for the inmates of an isolated country house to be seized with enteric fever although no case has occurred within many miles, and there is no evidence of the importation of the disease." My own experience of the disease in public institutions and in private practice in this country and in Paris, where it may be said to be endemic, confirms the view Murchison put forward with so much force. Briefly it is as follows:—

It is needless to occupy your time giving all the details of these outbreaks. The time at my disposal is too brief, and, besides, I am not sure that to do so would be profitable. The first two outbreaks of which I had experience occurred in Fifeshire, one in the country and the other in a village with 2000 inhabitants. In this village typhoid was not known for twenty years previous to this epidemic. In all 70 people were affected, and 7 died. In both instances it was clearly shown by qualitative and quantitative analyses that the drinking water from two wells was contaminated for some time by sewage escaping from the sewers and soaking through the intervening soil into them. I have known emanations from decomposing fæcal matters continuing for months to cause an outbreak of diarrhœa, and one case of typhoid in the apartment next the source of the evil. In none of the outbreaks was there a particle of evidence to indicate that

typhoid matter, either from a typical or masked case, had reached the sewage. Human observations are fallible: mine must be taken at their worth. During a prolonged residence in Paris, I had considerable opportunities of observing this disease, but perhaps in no city would it be more difficult to ascertain how the disease originated and how it was propagated. The water supply, which was far from good, may be excluded. We must look to the inhalations from sewers, cesspits, &c., and the miasms emanating from the *fosses permanentes*, and from ordure accumulating in dry-soil pipes. It was the existence in Paris of these polluted sources that led Brouardel and others to adopt the views of Charles Murchison. Many of those whom I have the honour to address can speak from a longer experience than I can—an experience which has led them to take another view of the matter. But these are the elements—precise, so far as I am able to judge—which I bring in support of the theory I have put forward as a contribution towards the ultimate solution of this grave question of public health. When the question was one of specificity *versus* spontaneous generation, we were reminded by eminent sanitarians at home and abroad, that the adoption of the latter theory destroyed the hope manifested by Budd and others of our being able to exterminate this national scourge. They significantly say "that if typhoid arises spontaneously, if we engender it in ourselves, if it arises from all the conditions, social and necessary, which surround us, we are deluding ourselves by chimeras in thinking that it will now disappear from our midst." I am not sure if this is true of spontaneous generation, for which a foul medium is necessary, but I may safely say it does not apply to the sewage or filth *per se* germ, which neither paralyses hygiene nor discourages research. The adoption of this view is most hopeful for sanitation.

I anticipate the objections that may be urged against these as instances of typhoid arising from sewage *per se*. I may be told, that the smallest quantity of typhoid evacuations may have reached the contents of sewers, cesspools, or privies, if not from a well-marked case of the disease, from a masked or ambulent case, or in some other mysterious way.

Nothing is easier than to throw doubt upon investigations carefully made with no other view than the elucidation of truth. Fortunately, however, for those who believe in the non-specific origin of the disease, similar doubts may be thrown upon the researches of those who never fail to find a trace of typhoid sewage in places where outbreaks occur. It may have been there from remote or recent date. The *crux* of the typhoid problem is undoubtedly the genesis of the germ. My

own conviction is, that it only arises from the decomposition of fæcal matter to which typhoid bowel discharges may, or may not have gained access. In short, typhoid discharges are not essential to its production. In the future, in a manner which I shall shortly indicate, it will be possible to prevent in towns and cities sewer gases from gaining access to our houses; in villages and the country districts filth heaps from becoming a nuisance from proximity to dwellings; and to preserve our water supplies from all sources of contamination. It may be said with almost absolute certainty, that the individual who contracts typhoid is *ipso facto* demonstrated, to have been exposed to excremental pollution of air or water.

Unanimity of opinion as to the origin of this disease I do not anticipate, but as to the hygienic measures to be adopted for its prevention I may assume we are at one. The figures already mentioned in your hearing have an importance other than to demonstrate the prevalence of typhoid fever. They shew very clearly what sanitation has already done, and may yet do for the health and well-being of this country. Going back over the Registrar General's Reports for the past twenty years I find that over a quarter of a million have died in the three kingdoms from typhoid fever alone, and nearly 400,000 from all the filth diseases, viz., typhoid, typhus, diphtheria, and a percentage of diarrhœa.

But this is not all we may glean from these mortality reports. They form an accurate starting point from which we may calculate approximately the number who have been ill, and recovered from these diseases. And what do we find? We find that for every death from typhoid ten have been ill, and for every death from the other three filth diseases seven. In other words, in the three kingdoms, from 1861—1880, 2,500,000 have been ill from typhoid alone, and 1,700,000 from typhus, diphtheria and diarrhœa. If instead of twenty years, we take one year, we see that 12,500 have died from typhoid, and 125,000 have been ill and laid aside from work for a period little short of three months. These are startling figures. All this means enormous loss to the communities in which typhoid is endemic, or epidemic—a loss which would have paid not only handsome interest on all the capital raised by sanitary boards, but also part of the capital itself. This loss I have computed from typhoid alone during the twenty years at £23,300,000, and from all the filth producing diseases (including typhoid) at £29,500,000. Thus you see, typhoid is *primâ facie* the disease of the future, which, whether we look at it from the pecuniary loss we suffer, or from the heavy tribute we pay in life, must receive the attention of sanitary reformers.

I have already shown by a method of calculation, which I shall now explain with the aid of a table, that this heavy mortality and sickness means a loss to the country of nearly £30,000,000 in the period selected.

Filth Diseases.	Proportion of deaths to number ill.	Average No. of days ill of those who died.	Average No. of days ill of those who recover.
Typhoid	1 in 10	20	90
Typhus	1 in 5	14	30
Diphtheria	1 in 6	10	30
*Diarrhœa	1 in 10	10	30

In the case of typhoid I have assumed that for every death 10 are ill, typhus 1 in 5, diphtheria 1 in 6, and diarrhœa (that per centage—20°/₀—due to sewer gases and foul emanations) 1 in 10; that those who ultimately die from typhoid, have lived on an average for 20 days, and that those who recover are laid aside from duty for three months. The funeral expenses I estimate at £5, and each day's loss of labour at the minimum of 2s. The same method of calculation applies to the other filth diseases, but the table *supra* explains all that is necessary for the purpose I have in view. With these brief explanations I leave all the filth produced diseases save typhoid, which more than any other furnishes an interesting commentary on the value of sanitation. My object with regard to it will be best illustrated by taking the history of typhoid in England during the last twenty years. Its victims in this period have been more than 200,000, but while during the decennial period, 1861-1870 the deaths were nearly 19,000 per annum, during the decade 1871-1880, the annual mortality fell to 7,800. And moreover, this fall has been in a steady and progressive ratio. To put the matter in another way, 398 of every million of the population died in 1869, whereas in 1880 only 261 per million. The splendid results achieved by sanitation will be seen even better, if instead of taking the whole of England we take individual communities. A few will suffice to serve my purpose.

* 400,000 have died from this disease between 1860—1880. Making allowance for the large percentage due to catarrhal enteritis, and the still larger percentage due to infantile diarrhœa (over 58 °/₀), I attribute 20 °/₀ to filth.

TOWN.	Deaths per million before Sanitary works.	Deaths per million after Sanitary works.	TOWN.	Deaths per million before Sanitary works.	Deaths per million after Sanitary works.
Bristol	1000	650	Edinburgh	540	326
Leicester	1460	770	Glasgow	1240	435
Croydon	1500	350	Dantzig	700	74
Merthyr-Tydvil ...	2100	860			

	1869.		1870.		1871.		1872.		1873.		1874.		1875.	
	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.
England..	8659	398	8731	392	8461	375	8741	382	8793	378	8861	377	8913	372
Paris.....	993	534	.....	.....	.....	.....	938	490	952	492	823	421	1048	532
Dantzig...	.....	.....	.....	.....	.....	.....	.....	700	.....	400	.....	500	.....	320

	1876.		1877.		1878.		1879.		1880.		1881.	
	Total Deaths.	Deaths per mill.	Tota Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.	Total Deaths.	Deaths per mill.
England..	7550	311	6879	279	7652	307	5860	232	6710	261	.....	.....
Paris.....	2032	1022	1201	589	857	411	1100	516	2120	973	2133	958
Dantzig ..	.....	250	.....	250	.....	180	.....	170	.....	74	.....	.....

With Paris, and many other cities where sanitation is in a backward state, it is otherwise. A glance at the table shows that the mean mortality per million in Paris in 1869–74 was 484; from 1875–81, 714 per million. The cause is not far to seek. Paris is in an unsanitary condition from the foul smells emanating from the sewers, from the *fosses permanentes*, from cisterns and cesspits, and from the ordure accumulating in dry soil-pipes. I know of no instance in this country where works of sanitation have been executed where the public health was not vastly improved. The carrying out of sanitary works means a heavy burden on communities. Money levied for the maintenance of the public health is money saved, not misspent; for not only is much misery and destitution averted, but valuable lives are preserved. Let me illustrate the truth of this statement by citing the city we meet in, with its population (674,000) only exceeded in this country by that of London. From 1861—1880 I believe nearly 6,000 persons have died from typhoid fever, which, from the calculations already made, would mean a loss to this community of £600,000, or from all the filth diseases £800,000. I do not say this sum would cover all that has been

spent in sanitary works in this city; but it would surely cover something more than the interest of capital thus invested.

The money loss is not for one moment to be compared with the loss of human life. But these matters must be put at a commercial value before they are rightly appreciated. There have been occasions when our governing bodies have been slow to spend money which would benefit the public health. I say this, not because I undervalue the great and good work done in this and other cities by men who have gone in heartily for sanitary measures, and these improvement schemes which, to a large extent, have demolished those fever-dens which were the favourite breeding beds of every filth disease. If a remedy is not provided for the prevention of typhoid and allied diseases, provision has to be made for the maintenance of the stricken poor in special and general hospitals and in poorhouses. It may be true that the number of typhoids who enter these institutions are a mere bagatelle, probably not more than one-sixth of all the zymotics. Let it not be forgotten, however, that the illness resulting from typhoid fever means a longer residence in hospital than any of the others; not only so, but the outbreak of this disease among the lower grades of society leads to pauperism and prolonged hardships, such as we can but faintly conceive.

Who are to blame for the defects in our sanitary system which lead to such diseases as typhoid, &c.? Public health acts have been enacted at long intervals, and these have failed to cope with the exigencies of our civilization. Sanitary reformers have proclaimed again and again the urgency of reform, but a deaf ear is turned to them, and it is only when the powerful voice of epidemics speaks that the necessity for some radical changes is apparent. Sanitary legislation may have come tardily and piecemeal, but we are not yet in that position when we can say that personal and domestic hygiene has reached that stage of perfection entitling us to think that sanitary authorities alone have failed in their duty. Communities with a pure and abundant water supply have no excuse for the neglect of the elementary laws of health. Personal and domestic cleanliness are matters which no laws can enforce. These must be left to higher conceptions of purity, engendered by educating and civilizing influences. What, then, are the changes needed in our sanitary codes which will be efficacious in extirpating this malady? The time at my disposal will only permit me to refer to these briefly. In their nature they will differ somewhat, as we have to deal with urban and rural communities—in the main they should agree. It has been demonstrated as clear as noonday that typhoid fever is intimately connected with sewers, privies, and cesspools. The bowel discharges gaining access to

the water we drink or the atmosphere we breathe vitiate them. All legislation, to be effectual, must put an end, as far as possible, to the possibility of these pollutions taking place. The sanitary area must be enlarged by adopting the county or combination of counties as the unit area of administration. All sanitary matters must in future be managed by a central authority composed of men duly qualified for the work. These are general matters; but specially there must be a thorough reform of what have been termed building regulations. These have reference to house construction, house drainage, size of rooms, and cubic space per head. Provision has already been made with reference to the laying out of streets, to sewerage and water supply, but, so far as I am aware, none with reference to the amount of free space within and around tenements, to house drainage, size of rooms, &c. The first flooring of a house should not be laid until the soil pipes and their connections with the closet and the sewer have been duly inspected and certified. As the laws at present stand, speculators in house property have it all their own way. They are free to build precisely as they choose, with the result that every inch of ground in some parts of our cities are covered with buildings. If there is one maxim in sanitary science truer than another it is this, that death-rate and density of population advance *pari passu*. For a long time we were in the dark as to the insanitary state of our house. But the dawn of sanitary science has arisen. Medical officers of health and sanitary engineers have with their limited powers been showing us how we may be living in an atmosphere fouled with the vilest gases and other poisonous germs. Sanitary protection associations have been established all over the country. Their reports, which I have been enabled to read, make the startling announcement that 80 per cent. of our houses are in an insanitary condition. It is only when typhoid has appeared and done its deadly work that the defects are ascertained and remedied. You are familiar with these reports. They carry the same sad tale. They run thus: "drains with insufficient fall-joints open—work scamped—trapping arrangements defective—connection established between water and soil-pipes—ventilator of soil-pipes appearing near bedroom windows." Such a condition of things is not confined to the tenement, but may be seen in the palace. Many a mansion-house, beautiful for situation, has had to be gutted to discover how the filth germs which beget typhoid reached the inmates. The primary inspection of pipes, joints, and traps, would not be all. There must be periodical examinations; and to carry this out the pipes, &c., must be laid in such a way as to admit of easy inspection.

The number of rooms in a house, and the number of persons to a room is important. One who has traversed the recent census statistics tells us the sad story that more than 40 per cent. of our great city populations live in one room. Surely this should not be in a country with an Artisans Dwellings Act, and where the Peabody bequest has demonstrated that comfortable dwellings may be constructed for the poorer classes who suffer from the ravages of typhoid. Not that I believe that the inmates of one-roomed houses are more exposed to the poison germs which produce typhoid than others, for I find the medical officer of this city has shown that such is not the case. In one-roomed houses w.c's should not be allowed to exist. And yet there are such houses. Building societies have shown that suitable and healthy dwellings may be provided for the poor and no one be a loser.

I now come to cubic space. It has an important bearing on typhoid. It is a matter the proprietory interest must not be allowed to settle as they choose. The amount at present allowed is utterly inadequate. While prison, poorhouse, and asylum managers have been constructing, with the aid of the public purse, institutions where 800 and 1,000 cubic feet are allowed per head, yet municipal authorities know that there are hundreds of fever dens still in large cities where there is not 150 cubic feet per head. Redress cannot come too soon. Public opinion is now prepared to endorse the remedies suggested by experts, no matter what the sacred rights of property may be. But in the light of present knowledge human life must be considered far and above these. Never was a clearer connection between cause and effect made out than that the thousands who die, or are ill and recover, perish or are ill from a water supply fæcally polluted and from defective sanitary arrangements. At present we have to wait until typhoid or diptheria makes its appearance before steps are taken to ascertain the cause. Since it has been shown that the milk supply from the country may be the bearer of disease germs, another weak point has been discovered in our Public Health Acts. These weaknesses demonstrate very forcibly the necessity for one code of sanitary laws and one kind of authority for urban and rural districts.

The last matter to which I shall refer is the existence of a hospital in the sanitary districts to be created, and the treatment there of all cases of the disease which cannot with safety to the public health be treated in their own homes. All these reforms briefly alluded to will have to be carried through before typhoid is stamped out. You have seen by the figures I have brought under your notice what city improvements, a good water supply, &c., have brought about. And shall we cease our

endeavour to obtain sanitary reform until typhoid is relegated to the place which its supposed predecessor-pest occupies? a place in sanitary history, as a beacon to warn this and future generations that such infringements of the laws of health as take place before this fever breaks out, is mercilessly punished with disease and shortness of days.

In conclusion let me say that if my beliefs do not coincide with the ideas and doctrines of the eminent men whom I have the honour to address respecting the origin and prevention of typhoid fever, I have too much confidence in the liberality of your opinions not to submit for your impartial consideration my doubts and reservations, hopeful that whatever your verdict may be, it will conduce to the public weal.

Dr. MACGOWN, Millport, said that his idea decidedly was that typhoid fever could arise *de novo*. If there was a well with contamination entering it long enough from a dungstead near at hand, there would soon be typhoid fever amongst people who partook of the water directly or indirectly. Seven years ago he dealt with an epidemic of typhoid, and he traced it to an impure well. Whenever that source was cut off the epidemic stopped. In all these epidemics in country districts it was found that the disease had its source in a well, into which ran the liquid from an adjacent dungstead. Frequently the water found its way into the milk, which in its turn reached towns or villages, and the result was typhoid fever.

Prof. DE CHAUMONT, M.D., F.R.S., thought it was an accepted opinion that the germs get into the water; referring to Dr. Sutherland's observations upon the prevalence of fever in the army as compared with that disease in the civilian population, said that in former days the two great diseases which killed our soldiers at home were consumption and typhoid fever. Now he was happy to say that both diseases had been so far coped with in the army that the rate of mortality from consumption was below the average rate amongst the civilian population, and the typhoid fever rate in the army was greatly below that of civilians of the same age.

Dr. SUTHERLAND, in reply, regretted that the point in his paper had not been quite apprehended. He did not say he was a supportet of the *de novo* theory. He thought he had stated clearly enough thar he did not believe in the spontaneous generation of germs. The point of his paper was this, that collections of fæcal matter, with or without typhoid discharges, held germs in their midst, and as decomposition progressed these germs altered their form and character, and, provided at a certain stage of change they by the usual channels reached

our bodies, where they multiplied rapidly, typhoid fever was established. All fæcal matter contained germs dangerous at a certain period of their history. Surely no one present was sanguine enough to believe that the Home Secretary would allow him to make the necessary experiments upon animals to verify the conclusion arrived at after an investigation into outbreaks; but when the false sentiments which now prevailed had passed away, he hoped to be able to make those experiments.

On "The Disabilities of Inspectors of Nuisances, and their Remedy," by E. C. ROBINS, F.S.A., F.R.I.B.A.

I was recently desired to take the chair at the establishment of a new Society, to be called "The Association of Public Sanitary Inspectors," and I acceded to the request because I have long felt that the labours of that very useful body of men—better known as "Inspectors of Nuisances," are too often handicapped by conditions very unfavourable to the satisfactory discharge of their duties.

And it has occurred to me that it might not be otherwise than useful if I were to embrace the opportunity which the holding of this year's Congress of the Sanitary Institute of Great Britain, at so important a centre as the City of Glasgow, provides for the ventilation of the subject.

The duties which devolve on these public officers are of a nature to bring them not only into contact, but also into antagonism, with their employers; and influences are brought to bear upon them which render it often a very unpleasant and ungracious duty to put in force the provisions of an Act designed for the public benefit, but opposed to the personal and private interests of parishioners, many of whom are members of the Vestry, Guardians of the Poor, or sit on Local Boards of Health in the district.

The support which the inspectors have a right to expect from their superior officers, such as the parish surveyors and medical officers of health, is oftentimes grudgingly given, or absolutely withheld, in cases where influential members of the local authority are concerned.

Medical officers have over and over again pleaded their inability to carry out the improvements they desire, because they are not made sufficiently independent of their employers, many of whom are also their private clients.

Earnest men, anxious to do good work, become *marked* men,

and are looked upon as meddling and officious persons, so that, unless a grievance is brought to the notice of the officer in the ordinary form of a complaint, he hesitates to report the existtence of nuisances which it is of great importance to the public health should be remedied at the earliest stage of their conception.

In short, the preventive measures which it is so important to institute prior to the breaking out of a disease, are postponed till the disease itself has appeared, and thus remedial measures are resorted to when too late to prevent their necessity.

Periodical house to house inspections are essential to the due performance of the duties of an officer of health, or inspector of nuisances, in the neglected portions of his charge.

I am aware that the extent of the areas under the supervision of one inspector is oftentimes too large and unmanageable for him to do more than attend to the complaints made, and little time is available for what he would consider supererogatory labours; and until the public understand the importance of these labours, they will not deem it desirable to augment the staff of such assistants.

But it is penny wise and pound foolish to act with parsimony in the matter of the preservation of the public health, the loss of which entails upon the parish such heavy responsibility and expense, especially in times of epidemic disease, and so largely increases the pauperism of the lowest classes, and the consequent burdens of the ratepayers.

The preservation of the purity of the drinking water; the provision of a sufficient supply for cleansing purposes; the regulation of the drainage, and the rapid removal of excreta, and proper ventilation of the system adopted; the removal of refuse and accumulated vegetable and other matters in private houses, manufacturies, slaughter-houses and dairies; the prevention of over-crowding and use of insanitary dwellings and marshy surroundings; the obstruction to the sale of unsound meat and other food, &c., &c., are all matters of vital interest to every member of the community. For, as a late divine observed:—

"Everything that tends to promote the welfare of the poorer classes, tends to the stability of the noble institutions of this country. He that connives at, and disregards the suffering, misery, and degradation of his neighbours, will not escape with impunity, for what he leaves to breed pestilence in the dark alley will arise and reach him in the grand square, and show the rich that they are never safe as long as they neglect their duties to the poor.

"The sanitary question was second only to the educational; air, water, and cleanliness have much to do with the moral condition of our country."

The vested interests of owners of inferior house property oftentimes stand in the way of public improvements of a sanitary character, because such owners have not yet learnt the increment of value which appertains to sanitary dwellings.

And vestrymen, as a rule, own a considerable part of such property, and therefore think themselves aggrieved if the parish officers exercise too indescriminate and impartial a supervision of it, and consequent readiness to report unfavourably upon it.

How is this to be met? By the bringing to bear thereon the force of *public opinion*.

But how is this to be done? I will give you an instance of how it *was* done in the year 1853, by a private society of which I took the management, and published the result of our labours in 1854, in the form of a pamphlet entitled, "A Practical View of the Sanitary Question."

This Society was established by the Incumbent of a church in the metropolis, who associated the leading men in his congregation to form a Local Board of observation, by whom a house-to-house visitation was instituted. The paid inspector reported to me, as Hon. Architect, the state of every house in the district, and I served notices in the following form:—

"I herewith give you notice of a nuisance existing on your premises, viz., (description of the nuisance.) And I hereby require you to remove the same in accordance with the provisions of the Nuisances Removal and Diseases Prevention Act."

In short, though possessed of no positive legal authority, our moral force was found to be sufficient. We made it our business to require what the spirit of the law required, and in the event of opposition we had only to point to the Sanitary Acts of Parliament and threaten to place the case into the hands of the legally constituted parish authorities, requiring them to put in force the powers with which they are entrusted for the protection of the public health.

Our experience proved that the majority of householders were more willing to accede to the mild representation of the requirements of the law made by the Board, than to brave the interference of the strong arm of the law itself, which constituted the reserve artillery, which the Board did not find necessary to bring into action in so many as half a dozen cases out of 93 landlords with whom the Board had occasion to deal.

Mr. Tom Taylor, Secretary to the General Board of Health, writing to me on the 12th of June, 1854, says:—

"If the constituted local authorities, whether in the Metropolis, or in other cities and towns throughout the country, were generally actuated by the same zeal, and guided by the same intelligence in the exercise of the powers for sanitary improve-

ment which the law has vested in them, as have inspired and regulated the purely voluntary and unofficial efforts of the Local Board of Health for the Regent Square District, I am to express the belief of this Board that it would be seen that, however defective may be the laws for the protection of the public health, it is the will and knowledge to put those laws in force that are most needed to effect the removal from amongst the dwellers in our towns, of the principal sources of premature death and preventible mortality."

As a matter of fact, the result of a single year's unofficial work in one small corner of the immense Parish of St. Pancras was that "1017 separate sources of infection were abolished, 4,000 cubic feet of fæcal matter were removed, and 6,180 lineal feet of foul house drains were cleansed or renewed."

I have not learnt what was done by the parish inspectors of nuisances during that year, but since our district was but the 280th part of the Metropolis, if similar philanthropic boards of health had been established throughout London, no less than 284,760 separate sources of infection would have been abolished, 1,000,000 cubic feet of fæcal matter removed and 328 miles of foul house drains renewed or cleansed.

The following is an extract from the Report of Dr. Sutherland on Epidemic Cholera in the Metropolis, 1854, as published in the Blue Books, and is therefore an official approval or endorsement of the plan of operations adopted by us:—

"It was not considered necessary at that time (September, 1854,) to institute any inquiry by inspection within the City of London, or in the large Parishes of St. Pancras or Marylebone, because the epidemic had visited them with comparative lightness; and, moreover, the President had reason to be satisfied with the activity of the Local Authorities, and with the proceedings taken by the Local Sanitary Committees.

"The voluntary exertions of the Local Board of Health of Regent Square Church district St. Pancras, headed by the incumbent, are worthy of the highest commendation, as affording an example of how much good may be accomplished, even in the present defective state of the law, by vigilance and well-directed effort."

The "Practical View" also contained a plan of the district, and a list of the owners of the property incriminated, and the works required in each case to be done, which extended to 211 separate houses, but no less than 2,491 primary and supplementary inspections were made, and 172 notices served on 93 different landlords, many of whom were vestrymen.

And now what is my *moral?* What is my remedy for the apathy of the public? My specific for quickening the con-

sciences of owners? My suggestion for the support of these public officers to whose disabilities I have referred?

Why, simply this. Let the energetic few in every district, in every parish, take the matter to heart, and forthwith establish a private society such as that the success of which I have described. Let their honorary, self-sacrificing labours for the benefit of all exercise its moral influence on the rest, and let their house to house inspection result in drawing the attention of owners to the insanitary state of their premises, and they will achieve a greater saving of life than will ever take place by the action of the auxiliary forces, the so-called volunteers.

Let us establish a sanitary, life saving, health giving volunteer movement, and let the officers of the parish authorities feel that they are supported in their arduous and unthankful labours by the public sympathy which such institutions will prove, and we shall hear no more of the unrighteous use, made by the powers that be, of the influence they possess to the discouragement of honest, earnest, and capable public sanitary inspectors.

Since writing the above my attention has been called to a letter on behalf of working men addressed to the papers by Miss Toynbee (daughter of the late celebrated and self-sacrificing aurist) who is the hon. secretary of a society just established, entitled the "*West Marylebone Sanitary Aid Committee.*" In this letter the urgent need of applying sanitary principles to the homes of the poor, is very ably enforced, together with the fact that the agencies at present existing do not achieve the desired result.

Neither the "Sanitary Protection Association" nor the "Sanitary Assurance Association" has succeeded in reaching the homes of the working classes. The co-operative principle upon which these philanthropic societies are based, has reduced professional fees to a minimum, without inducing owners of small properties to become members. The parish authorities only attend to cases brought before them, and the poor, not being owners of the property they occupy, find difficulty in getting their homes made healthy, but the "Sanitary Aid Committee" referred to, have pledged themselves to undertake the investigation of complaints *made to it* by district visitors, clergymen, or the tenents themselves, and to report them to the parish authorities. It has not yet ventured upon a house to house visitation, but doubtless this will follow, the St. Pancras example, before described, having proved that one system is not more likely to give offence than the other.

The Marylebone plan has, however, the advantage of lessening the outgoing expenses of the committee, the parish officers alone being employed, instead of the independent and specially paid

inspector, directed by an achitect or surveyor, who might not always be found both able and willing to act in an honorary capacity, consequently I deem this most recent local effort of sufficient importance to warrant my pressing it as an example upon the attention of the philanthropic public, the extreme simplicity of its organization being its best recommendation.

In conclusion, I may state that there are other disabilities of Inspectors of Nuisances, some of which have been summarized by one of their number as follows:—

"We get no credit for work well done, because—

1st. We are not districted;
2nd. We never make direct reports to the Board;
3rd. Our names are never mentioned in the annual reports of the Medical Officers of Health."

Doubtless the work done by the Inspectors has not received much direct acknowledgment, and this is a discouragement. But in connection with the new "Association of Public Sanitary Inspectors," opportunities will occur not only for stating their grievances, but of popularizing their work.

The Sanitary Institute of Great Britain has established an examination for testing the technical qualifications of junior officials, and if the new society encourages the rising candidates for such offices to obtain this certificate, it will do much towards establishing a more liberal recognition of their merits in these days of competitive examination for official positions of any kind. It may also encourage the Sanitary Institute to admit public inspectors of many years standing and approved capacity to their associate class of members, without examination, being full members of the Association of Public Sanitary Inspectors. The objects of which association are thus defined:—

"1st. The promotion and interchange among its members of that species of knowledge and practice which falls within the department of an inspector engaged in carrying out the duties imposed upon him by the Public Health, Local Government and other sanitary Acts of Parliament.

"2nd. The general promotion of the objects of sanitary science in connection therewith."

Dr. NAISMITH, Ayr, wished to say a few words on the condition of sanitary inspectors in the smaller provincial towns in Scotland. Undoubtedly in the larger cities—such as Edinburgh and Glasgow—sanitary inspection was satisfactory. There the inspectors were under no local influence to speak of—at any rate of a personal nature

—and they were so far independent, and more or less completely under the control of the medical officer. It was otherwise in their smaller towns—he spoke of towns with a population numbering from ten, fifteen, twenty, or even thirty thousand. The medical officer in such places was undoubtedly usually a good man. He had under him perhaps, two—sometimes only one—inspectors of nuisances. These men were usually natives of the place, and although they might be excellent men otherwise, they were generally only half trained as sanitary officers, and were hardly men suited for towns of the size he spoke of. Again, the sanitary inspector was very often allowed to engage in some other occupation. He might be allowed to collect gas rents and act as School Board officer as well, in which case he would be opening the doors of refractory parents and children with one hand and opening the door of an infected dwelling with the other. He was also undoubtedly very much under local influence, and he was too much under the authority of the Sanitary Committee of the town. The inspector was not, he took it, sufficiently under the control of the parochial medical officer, under whose eyes he was directly employed, and whose instructions it was his duty to follow. The speaker thought they should have inspectors specially trained, who would be procurable from the staffs taught in our large cities, and who should certainly not be allowed to engage in any other occupation. The inspector should also be removed from all other direct authority except that of the parochial medical officer, who was his chief. If these things were not done he thought that towns of the size he had referred to would be heavily handicapped, and not only so, but the men employed in sanitary inspection would be handicapped also.

Dr. Simpson, Aberdeen, endorsed the views put before the meeting by Mr. Robins. The grievance, he said, might be worse in the smaller burghs, but he believed it also applied to the larger towns. He considered that sanitary inspectors should be under the Board of Supervision, and be responsible only to that body. Medical officers of health, he thought, should also be placed in the same position. Those in the larger towns were, no doubt, more independent, but those who were in private practice could not do their duty while there were large proprietors probably patients of theirs. He hoped that in any new bill which would be brought in for the amendment of the Public Health (Scotland) Act medical officers of health and sanitary inspectors would be placed under the control of the Board of Supervision, and not be removable without their sanction.

Mr. T. Harnett Harrisson, Liverpool, said that in one borough he knew of, jobbery was the great paralyser of the Public Health Act. In the borough he had in his mind the chairman of the Board of Health was the largest estate agent in the place, and the vice-chairman of the same Board was the second largest estate agent, so that the two chief masters of the man employed to carry out the Public Health Act were under the pressure that was likely to be exercised

upon them. This evil, he knew, existed to a large extent in many other boroughs. On the other hand, he was sorry to say that he had known such a thing as the Public Health Act being paralysed by the purchase by an interested person of the sense of smell of the inspector of nuisances for half-a-guinea.

On "The Sanitary Condition of Glasgow, and the means of Improving that Condition," by G. W. MUIR.

THE health of Glasgow has for some time been unsatisfactory, notwithstanding the great expenditure of money in attempting to improve its condition. Glasgow is known over the world as a great centre of industry and trade. Were it to be made more healthy it probably would become as well known as an agreeable place of residence, for it is well built, well situated, and possesses great educational facilities, a matter of some importance to parents having sons to educate and place out in the world. It must be distressing to the authorities to find that the city under their charge compares unfavourably, in point of health, with other centres of population, and with other places in the immediate neighbourhood. At the time the deaths in Glasgow were at the rate of 25 per 1000 per annum, the rate in Edinburgh and in the suburban burghs to the west and south of Glasgow, did not exceed two-thirds of the rate in Glasgow. It is not easy for an outsider who has not access to the register, to account for this state of matters. The death-rate is stated for the whole city, and while the numbers at different ages are given, the airy west and the smoky east are slumped together.

Some part of the unusual mortality, it was said, might be ascribed to the east wind, but this, it was found, could not be the case, seeing that the rate in the neighbourhoods equally exposed to the east wind, and in Edinburgh, where that wind is notorious for its severity, the mortality was so greatly less than in this city. The Venerable Sir James Watson—at one time Lord Provost—did much to make it believed that the great Improvement scheme had been successful, both financially and sanitarily. Time has shown that, in both respects, it has been a failure. The cost to the ratepayers is many thousand—probably half a million—pounds. The only persons who benefitted financially were the owners of the old property purchased, the buyers of sites from the Commissioners have, most in nearly all cases, lost heavily by the investment. In many

cases, the rents drawn from the new tenements are not sufficient to pay the ground rent. I have no hesitation whatever in saying that, so far as health is concerned, a better result would have been attained by the preservation of the old buildings, coupled with more attention to cleanliness.

Although the sanitary condition of towns is dependent greatly on other causes than draining and cleansing, yet I understand that a sanitary institute does not entertain the consideration of any other causes. I will, therefore, confine my further observations to draining and cleansing, and the means by which those may be secured in greater perfection than they hitherto have been. I may, however,—in fact, I must, otherwise the consideration of the subject would be incomplete,—notice the state of the Statute Law, and the amendments required to secure greater efficiency.

As regards house-drains, recent inspection has shown that the houses in some of the best parts of the city are in the worst state. The application of the smoke or smell tests has surprised not a few proprietors and tenants, when they by these tests discovered the condition of the drains passing under the houses from the conveniences at the back to the street sewer at the front. This state is not surprising to any one who knows the status of intelligence possessed by the men generally employed in laying house drains. As regards sewers, Glasgow may be considered well off, although the central and western districts are frequently subject to very offensive smells. These smells prevail chiefly over the area on the north bank of the Clyde, bounded by the river on the south, High Street on the East, the Kelvin on the west, and George Street on the north. The district which may be called the north-west, laying between Saint Rollox on the east and the Kelvin on the west, is peculiarly exposed to these bad smells. They are caused by the combination of refuse from manufactories of almost every description combining with the domestic refuse of a population numbering over 100,000. As all the sewers fall into the Clyde within the limits of the city, and as in every case (I believe) the mouths are closed by the tide for some time before and after high water, it of course follows that the contents of the sewers are dammed back for some hours daily, thereby causing the foul gasses to be driven back to the houses on the highground, so far as they do not escape through the street gratings, or into the town houses by the bad drains.

On the matter of cleansing or scavenging Glasgow cannot justly boast. The most public streets are tolerably well attended to, but the less public and the lanes that run between them are many of them in a very dirty condition, offensive to both eyes

and nose. The authorities have for many years maintained vast collections of manure within the limits of the city, and they have for some time been busy establishing what they are pleased to call manure dispatch works, in spite of remonstrances from the inhabitants who suffer from them. These so-called dispatch works are, in truth, manure factories, and are defended on the sole ground that the quantity of refuse in Glasgow is so great that every effort must be made to manufacture an article worth the notice of the farmer. A very proper object in itself, but it should be attended to at a greater distance from inhabited houses than these dispatch works have been located. The provisions of the Public Health Act, 1867, are violated daily and hourly by the sanitary authorities of Glasgow. It is true that an exception in the Act is plied as justifying the situation within the city of great heaps of most offensive refuse. Why such an exception should be considered to be an advantage is a puzzle to me, and the fact of its being taken advantage of furnishes a proof of the low state of feeling or opinion of the sanitary officials and the members of the local authority. In the collection of the most offensive portion of refuse (the contents of the latrines in factories) no attempt is made to deodorise before conveyance through the streets to the works; and this is defended on the ground of economy. It would have been well for the city had this same profound desire for economy been followed in other matters of much smaller importance for the well-being of the inhabitants.

How, then, is the present state of things to be improved? House drains should be carefully constructed and periodically inspected; the sewers should have deodorants poured into them from their beginning to their termination; and the Public Health Act should be amended by empowering the imposition of personal penalties on officers and members of local authorities who neglect their duties. Penalties paid out of the rates are not felt by those upon whom they are nominally imposed. The local authorities are supposed to be under the control of the Board of Supervision in Edinburgh. Nothing more inefficient than that supposed control can be imagined. The local authorities can sue private individuals for penalties if the Public Health or local Police Acts be infringed, these same authorities being, in many cases, the greatest violators of the provisions intended to protect the public weal. It might be too much to say that the high death-rate prevailing in Glasgow is to be ascribed to the action or inaction of the local authority; but it cannot be denied that, if great collections of public refuse near to dwelling-houses, and within the limits of the city, are nuisances and injurious to health, then some portion of the

death rate may justly be said to have been caused by the default of those to whose care the public health has been entrusted.

Dr. A. CARPENTER said with regard to the paper read by Mr. Muir, he was sorry at certain expressions contained in it, because he (Dr. Carpenter) was so convinced of the high state of efficiency that existed amongst the officials of Glasgow, and of their desire to promote good sanitary work. He was sorry indeed that an attack had been made upon them. He was certain that the officials of every town represented to a great extent the intellect of that town, and when an attack was made upon officials for not doing something which the assailant thought they ought to do, it really meant an attack upon the representatives who had appointed these officials. and from the representatives an attack upon the people. He was quite sure that the Institute coming to Glasgow had no anticipation whatever that any kind of attack would be made upon its citizens, or upon those whom they appointed to represent them. He knew from his own personal knowledge that the effect of the sanitary operations of Glasgow had produced the most beneficial results, and that, with these results, however great, the officials themselves were not satisfied, but that it would be their endeavour, undoubtedly supported as they would be by the people of Glasgow, to reduce the death-rate from 25 or 26 to nearly the death-rate which it ought to be, of perhaps 16 or 17 per 1000.

Mr. G. W. MUIR, Glasgow, in replying said, with reference to the attack on the authorities and officials of this city, he had only to say that he had not followed the example of the gentleman from Southport, who had come there to read a paper about Southport. He had made the attack in the place where it might be answered. He was not afraid of the statements he had made. He could prove them, notwithstanding the laudatory terms in which Dr. Carpenter had spoken. The officials of Glasgow, he believed, were about as good as any other officials—but what he said was that he hardly knew any officials who did their duty. They would have an opportunity of judging. It had been intimated to them that they would have an opportunity of seeing old Glasgow in photograph. He was very sorry that, with few exceptions, it was the only sight they would have of the good old town. But he could also give them directions which were not in the programme of interesting places that they might visit in Glasgow. They might go to the enormous dung heap at Pollokshields, about two acres in extent; they might go to the one nearly as large in Baltic Street, Bridgeton, and there they would see the system that had obtained in Glasgow until very lately. Then they might also go to Charles Street, St. Rollox, and they would see

one of the dung manufactories. Now, these were the property of the Corporation, and they were in direct violation of the terms of the Public Health Act of 1864, which provided that no such things as these should be within the bounds of the community, or anywhere within fifty yards of any dwelling-house. The thing was intolerable to him to hear men lauded who he knew had systematically broken the law. There was another thing. On Saturday afternoon last he spent an hour or two in walking through the mews lanes in the immediate neighbourhood of where they were met, and if they wished to see modern Glasgow in its reality, and not in photograph, they should take a walk down those mews lanes. They would find that at every house, the rents of which would be from £100 to £150, there was a great, big, deep pit in the rear, where stuff was deposited aud allowed to fester from six to twelve months. The commonest sense would show that that system should be immediately abolished. He should have liked to hear Dr. Carpenter explain how it was that while the death-rate in Cathcart parish, two miles from where they were met, and the death-rate in the burghs of Govanhill and Crosshill was 16 and 15 per thousand, the death-rate in the city was 25 per thousand. That would have been something like answering the attack. He was sorry to have to attack the officials of Glasgow. He knew them almost all personally, and he should like very well if he could speak favourably of them. Whenever he could, he did so.

On "Notes on House Sanitation in and round Glasgow," by GILBERT THOMSON, M.A., C.E.

During the past year I have examined on behalf of the Glasgow Sanitary Protection Association close on three hundred houses. A number of these were country houses of various sizes, but the majority were in the city and suburbs of Glasgow, and varied from single flats to some of the largest and most expensively fitted houses in the district. As a rule, however, they were of the better class.

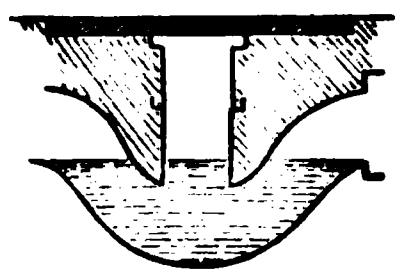
In the course of these examinations, a great amount of both good and bad work was seen, and the following notes have been selected as being likely to be of general interest. A first-class house in Glasgow contains a considerable amount of plumbers' work, and from what I have heard of other places, my impression is that the quality here is rather above the

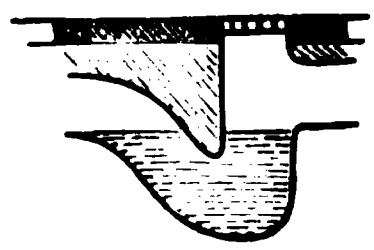
average. The laying, and more especially the repairing of fire-clay drains, is to a considerable extent in the hands of the plumbers.

In considering the drainage system of a house, everything outside the main-trap or traps may, as a rule, be disregarded. There are many instances, however, in which that does not hold good, and where the state of the sewer outside the trap may affect the house almost as seriously as its own drain. It is no uncommon thing to find a terrace in which the common sewer runs under the front or back areas of the houses, sometimes so close that there is not room for a trap between the house wall and the sewer. The condition of the sewer is often very doubtful, and unfortunately, except by actual opening up, it is very difficult to discover if anything is wrong. In one such sewer, which was exposed recently, the joints of the pipe were perfectly open, and on three or four lengths of pipe there was a fall the wrong way of three or four inches. Naturally the foundations of the house were far from dry.

In the same connection may be mentioned the danger which may arise from the bad drainage of adjoining houses. The following case illustrates that very strikingly:—An outbreak of diphtheria took place in one of a row of self-contained houses, and the proprietor, suspecting his drains, employed a plumber to put his house in order. The drains were found to be very bad, but were thoroughly overhauled. Not very long after there was another outbreak, and our association was applied to. The house was examined and found to be very satisfactory. Permission was then obtained to test the two adjoining houses, and a quantity of paraffin was introduced into the drains of each. In a few minutes the smell of paraffin found its way from one of them into several parts of the house first tested, causing a strong suspicion that the disease germs had got access in the same way.

Coming to the house system itself, the main trap is the first thing to be noticed. The form most commonly met with is what is known as a common lying trap, that is, a syphon bend with a centre eye for cleaning. There are also a number of built cesspools, more or less tight, but both of these are gradually being superseded by ventilating traps, which are designed to admit fresh air into the drain. Of these Buchan's trap is the one that is generally used. The change is doubtless a great improvement, but it does not do to entrust the alteration to unskilled hands, for some men





have evidently no idea whatever of the use of a trap. The following case came to light recently:—

A proprietor was not very sure about his drains, but in order to make sure that no gas from the main sewer could enter the house, he had a Buchan's trap put on the outlet. Some time after a house two or three doors off was tested with paraffin, and in the basement of this carefully guarded house the smell was noticed very distinctly. An examination was then made of this house. The drain was found to be in bad condition, and the trap was arranged with great care, so as to be absolutely useless. It had two openings, one on each side of the waterseal. The one on the sewer side should have been plugged, and only opened if required for cleaning, while that on the house side should have had a grating at the surface for ventilation. In this case, however, both were left open, a brick box was built round all, and a close-fitting flagstone was set on the top. The passage thus formed over the trap was evidently taken advantage of both by sewer gas and by rats. In another house a Somerset trap, which is somewhat similar in construction, was set in a style not much better.

The following plan was still more efficacious for the admission of sewer gas. An old house had a built drain under it, which passed to the sewer through a built cesspool, trapped by means of a stone tongue. The drain, apparently, had not been tight, as a bad smell was complained of. Thereupon, men were set to open the drain and to lay a fireclay pipe through the house. This they did by taking off the covers of the drain, laying a fireclay pipe in the bottom, and replacing the covers. The end of the pipe merely projected into the cesspool. This arrangement, of course, left free connection between the cesspool and the old drain, *outside* the new pipe. To make a complete job, the tongue of the cesspool had been broken, either during these repairs or previously; and its trap being thus destroyed, the house was left in full communication with the sewer. Fortunately the atrocious smell led to an investigation before anything worse than occasional sickness had resulted.

With regard to the house drain, it would seem that the average Glasgow house, though very far from perfect, is considerably better than the average London house. The drains are often found to be leaky and dirty, but it is a rare thing to find a house in which the bulk of the sewage at least is not passing away. The great majority of the drains are fire-clay pipes, sometimes cement jointed, sometimes clay jointed, and sometimes not jointed at all. A large number of them are found to be defective when tested with paraffin or smoke. One case was very instructive as showing how a very bad state of

the drains might be quite unsuspected, even on a partial examination. The house was a comparatively new one, perhaps three or four years old. The drain was readily accessible at an open trap outside the house, and on running water from various baths and closets, it was seen that the water came freely and clean to this trap. On testing the drain with paraffin however, the smell appeared immediately throughout the basement, and it was found that a branch of the drain from the foot of a soil-pipe was for a length of six or eight feet smashed to pieces. This soil-pipe was only from one closet, which had not been tried at first, but it was sufficient to convert a space of several square yards into a dunghill. Curiously enough, no smell had ever been noticed, and no illness had ever taken place in the house. A common mistake here is the excessive size of the drain-pipes. I have seen a 12″ pipe from a single soil-pipe, and 9″ pipes are very frequent. Cast-iron pipes are beginning to be used here for the horizontal drains, but as yet to a very limited extent. They are generally coated with Dr. Smith's composition, and jointed with lead. The usual diameter has been six inches. Though there is no doubt that a fire-clay pipe may be made tight, there is I think as little that the iron pipe is superior.

Lead is now almost discarded here as a material for soil-pipes, iron having taken its place. The joints are made generally of red lead and hemp, staved into the faucet. When the pipe is heavy enough and when the jointing is well done, the job is a safer one than a lead pipe would make; but there is the danger that light pipes, which will not stand proper jointing, may be used. On the whole, however, I have found fewer defects in iron pipes than in even comparatively new lead ones.

In a great number of cases the same pipe does duty both as a soil-pipe and as a rain-pipe, the lower part being 4 or 4½ in. diameter, and the upper part about 3 in. I have frequently found, in testing, that a smell of paraffin which was noticed in the house was distinctly traceable to the top of a rain-pipe, from which it was blowing in through a ventilator, a skylight or cupola, or even under the slates. The entrance of foul air in this way is therefore not merely a theoretical possibility, as it is often thought to be, but an actual fact. Offices, warehouses, and the like, with low-roofed wells surrounded by higher buildings, frequently receive foul air from the short rain-pipes.

There is one advantage, however, in the practice of using rain-pipes for soil-pipe ventilators, and that is that it ensures some sort of continuity in the pipe, and that it will end outside: otherwise, there is no saying where the air-pipe may go. This of course refers to existing houses more than to future ones. I

have found a house in which the air-pipe ended in the attics, and another where a pipe, which appeared outside the roof as a proper air-pipe, had a want of continuity, part of it having slipped down, with the result that the drainage system was largely ventilated into the nursery. Zinc pipes, more or less tight, are sometimes seen. On the other hand the arrangement is, in many cases, found to be very good, and the workmanship thorough, for a large number of plumbers in Glasgow are quite competent both to design and execute good work.

The practice of putting up separate pipes for closets, and for such fittings as baths and basins is extending greatly, and besides its other advantages, has the important one that the connection of the closet trap into the soil pipe has a much better chance of remaining tight when no hot water passes through it.

Of the water-closets in use here, the pan-closet is most frequently met with, even in the better class of houses. In them, however, it is steadily being displaced, the usual substitute being the Bramah. The writings of sanitarians have been effective so far that a considerable section of the public is quite aware that a pan closet is not a good thing, and this will, no doubt, come to be more and more considered by builders. In new houses pan closets are sometimes put in, which in their outside appearance and mountings have, when boxed in, some resemblance to Bramah closets. Bramah closets are largely manufactured in Glasgow by a number of makers. The frame and trunk are generally of iron, and the valves have India-rubber seats. They are made at prices ranging from about £2 10s. 0d. to about £4 10s. 0d. Many of them have ingenious lever arrangements to give a short lift, but I am not sure that the advantage is worth the extra cost. There are also a number of wash-out and hopper closets used, the prices of some of the latter being as low as 10s. or 12s.

When Bramah closets are used, syphonage of traps is a very decided danger. It is seldom safe to assume that any such closet is certain to leave both its own trap and the neighbouring traps full of water, and the test which I generally apply is to disconnect the water supply, fill the basin up to the overflow, and, when the water has come to rest, open the valve. The seal of the trap is then measured, and compared with the measurement after running water slowly in. A lookout is also kept at any fittings near for the sound of air gurgling through their traps. On referring to my notes, I find that about 250 Bramah closets have been thus tested, and of these about 60 affected distinctly either their own or neighbouring traps. The latter case is the most serious, because usually the closet trap in actual use will be filled again at once, but if a basin or bath

trap is syphoned it may remain empty for an indefinite time. One such case was a basin close at the side of a bed, the trap of which was invariably emptied by the use of a closet off the staircase. When a closet with what seems to be a sufficient air-pipe acts in this way it generally turns out that the air-pipe is choked or obstructed, as, for instance, by a bird's nest. It is a common practice to provide ventilating pipes from the trunks of closets, both Bramahs and pans. These pipes, in a number of instances, lead to a serious defect, as by them the trunk of the closet is sometimes directly connected with the soil-pipe, the assumption evidently being that the current of air will always be upward and sufficent to prevent any back draught. This, of course, is very far from the truth.

Basins and baths are occasionally found to syphon their own traps, more especially when the outlet-valve is closed, before all the water has passed out. The most common case is when a small pipe has been put up for one or two basins, and is not ventilated at the top. In one such case a ventilating pipe from the top of the trap was recommended. Shortly after we were informed that this had been done, but that the gurgling sound was as plain as ever. An examination showed that the ventilating pipe had certainly been put in, but that it was connected to the wrong side of the trap.

The water supply in Glasgow involves less danger than it does in many places, as the greater part of water for drinking and cooking is now drawn direct from the main. In most cases the scullery and pantry sinks, at least, are supplied in this way, and the general rule now is, that all baths, basins and sinks are supplied direct from the main. In addition to this, it is compulsory that in all new work, the cistern overflow pipes should end openly, and this removes one chance of pollution. The old place for the overflow pipes was into the bottom of the closet trap, and much more rarely they are found to be run direct into the soil-pipe, and in these cases they are generally trapped in some fashion. These traps are usually dry.

One very fruitful cause of danger is the thoughtless disuse of various fittings. The idea is very prevalent that when a closet or basin is little used the danger is correspondingly small, and I am frequently told that "this closet is hardly ever used;" the inference often being that it is hardly worth while looking at it. The very reverse is of course the case. One instance of this I saw lately. A large house had a closet off a bed-room, but it was thought not to be a good thing, and ordered to be taken out. The closet was taken out, but the cistern was allowed to remain. The overflow-pipe of the cistern went direct to the soil-pipe, and had a bell-trap on the top. The chances

were against this bell-trap being effective at any time, but the cutting off of the water made the matter quite certain, and left a good-sized opening for foul air to enter. Another house had a day and night nursery, each provided with a basin. This was thought not to be very safe in the night nursery, so the water supply was cut off. The trap before long was quite dry, but, fortunately, the danger was discovered soon after. Another instance of this was where a bed-room had been converted into a conservatory, and the basin into a flower-stand.

The examples I have given have all been found in and round Glasgow, except that the numbers of Bramah closets tried for syphonage include country houses as well. The country houses were, as a rule, less varied in their character, that is, more of them were either very good or very bad. The probability is that unless a country house is new, or has been recently overhauled, its drainage will be bad; and even if the work is recent it may not be above suspicion. In the older houses built drains of large size, and cesspools which are of course never cleaned, lie hidden in the most unlikely places, and very commonly the air from them can enter the house freely. It is, however, needless to generalise on such subjects with a view to showing that danger exists, as it must be evident now to everyone that bad drainage is extremely common and very dangerous.

PROFESSOR JAMES THOMSON said, with regard to Mr. Gilbert Thomson's paper, he very much approved of the efforts of the Glasgow Sanitary Protection Association for which Mr. Thomson was acting. He, Professor Thomson, was himself a member of that Association, and he thought it would do a great deal of good, He wished to ask for any information that Mr. Thomson could give as to the relative merits of the smoke test and the paraffin oil test. The smoke test, he considered, had the important advantage of giving very strikingly visible indications of leakage, and of helping, often very effectively by eyesight to the detection of the places from which the leakage proceeded. He would like to know whether the percolation of the paraffin oil into the ground under dwelling houses in case of the pipes being in fault, was ever found to produce any long continuing nuisance in the house where the test was applied, or in neighbouring houses. Of course he considered the smoke test was a little more difficult than the pouring in of paraffin oil.

Mr. E. C. ROBINS, London, was glad to hear that there was such an association carrying on operations in Glasgow. He was vice-president of a similar society which had lately been founded in London,

and it had wrought very successfully. They were enabled to give much assistance to householders who were anxious to improve the sanitary condition of their dwellings, but did not know how to set about it. He had never used the paraffin test, but had found oil of peppermint mixed with hot water to answer very well. If anything, the smoke test had the advantage over others, as it could be both seen and smelt.

Dr. A. CARPENTER said they should be careful whilst making all these arrangements to prevent the introduction of sewer gas, and also careful while fortifying the fortress, so to speak, of the individual house not to leave the drains and sewers in such a condition that gas might be generated with impunity. Wherever there was a development of that kind in any particular sewer, that sewer was defective, and it was to that defect that attention ought to be specially directed. Everything should be done to prevent the development of that which was certainly not a necessity of the sewer system. Any sewer system which gave out gas was defective, and on no condition ought to be allowed in connection with sanitary work which permitted putrefaction to take place in the sewers. These ought to be as clean as the kitchen sink should be kept by the cook, then no evils would arise from the drains. That was the great principle which ought to be at the bottom of all sanitary operations.

Mr. H. H. COLLINS, London, said he could not help recognising the difficulty of getting a sewer into the admirable condition which had been portrayed by Dr. Carpenter. To obtain a gradient to make the sewer a satisfactory one the ratepayers and Local Authorities would have to be appealed to. It would, however, be difficult to convince the ratepayers that it was necessary or desirable to spend money for such a purpose. If he found a sewer defective he would do his utmost to disconnect the house from it, and leave it to the Local Authorities to do the remainder. A large amount of good could be effected by flushing the drains regularly. Though he had not used paraffin oil, he had employed peppermint and ether, for the purpose of tracing the escape of sewer gas, but he had a preference for ether. In this way he had always been able to discover any escape of sewer air.

Mr. GILBERT THOMSON, in reply to Professor Thomson's question, said the smoke test had this advantage over the other, that it was visible, but on the other hand the paraffin test was easily and rapidly applied. He had experienced very little difficulty in getting at the exact spot where a defect existed when using paraffin, as the smell could not be mistaken. The mode of applying it was to pour it from the top into the soil pipe or conductor.

On "The Case of Southport. An Illustration of the Danger which Threatens the Existence of a Health Resort," by STRETHILL H. WRIGHT, M.D.

MR. PRESIDENT AND GENTLEMEN,—I have been led to believe that a very short paper, dealing with some features of that product of the conditions of modern life—a health resort—might not be unwelcome to the members of this association; and that some of the dangers which are very apt to threaten the well-being of a growing health resort, might be fitly considered on this occasion.

A health resort I define to myself as a place possessed of such natural hygienic advantages, that the workers in the hives of modern industrial life, and the sick and the invalid, are drawn to it—the first to secure for themselves and their families healthy homes away from the great centres of industry; the others bearing the burden of hereditary disease, or overdone in the battle of life, come to it, to recover it may be health and vigour amid sanitary conditions best fitted to promote recovery from temporary illness, or to render life more endurable in circumstances of chronic ill-health. So thinking I am justified in advancing the proposition that any sin against the laws of hygiene in a health resort inflicts injury, not only on its inhabitants, but also injury, it may be deadly injury, on the numbers of those whose welfare depends upon the preservation for them unimpaired of those conditions of healthy living, which have in health resorts been provided for their use.

I think it is not a bad plan in considering any subject to select a special instance illustrating it, and, by dealing with the special instance, establish an example for imitation or avoidance.

I shall, acting on this belief, take the town of Southport, in Lancashire, a health resort which, with its suburb of Birkdale, has, during the last fifty years, risen from a fishing village planted in the midst of Sand Dunes to a town of 43,700 inhabitants. Southport and Birkdale are, however, two distinct places: Southport is a borough, Birkdale is under a local board. It is with Southport borough we have to do—a borough, I believe, with the high rateable value of £200,382, on the census, 1881, population of 32,191 persons.

I shall, in the following, beg very shortly to describe to you the position which Southport, during her fifty years of life, has

attained in this part of the country where she has grown; the reasons which have qualified her for taking that position; and the dangers which now threaten her prolonged prosperity. And I shall ask you to remember that what I describe as the dangers which threaten Southport are also dangers which threaten all towns of like pretension and like circumstances. Southport owes her rapid growth and favour with which, until recently, she has been regarded, to the possession of great natural advantages. Men of business from Liverpool, Manchester, and all surrounding Lancashire manufacturing towns, have, when their position in the world has been secured, flocked to Southport, that they might in it establish homes where their hours of leisure might be passed, their families live, and their children be reared, amid the conditions necessary to a healthy life. Invalids have frequented the town in numbers because they found its remarkably equable and dry climate, its flat surfaces, and its thorough ventilation by south and west winds, were favourable to the re-establishment of health.

Southport has grown as the home of well-to-do people and as a worthy sanitorium for the North of England. I believe that very fairly have many of the indications of a correct sanitation been carried out; but in one very important particular the municipal authority of the town has failed; it has failed to provide the town with a satisfactory system of drainage, and, I fear, has failed to appreciate the requirements of Southport in this important particular.

I have stated that Southport possesses great natural advantages; but I again urge the expression of my belief that these are in process of being altogether nullified by an unsatisfactory drainage. Allow me to adduce facts in support of these allegations.

Southport is situated on the Sand Dunes, nearly midway between the estuaries of the Mersey and the Ribble, on the seaward margin of an immense open tract of flat country. A section of the soil, a mile-and-a-half inland from the sea beach, would give peat superimposed on clay; as the sea is approached gradually the peat is overlaid with a layer of blown sand of thickness varying according to the inequalities of the sand-drift. By degrees the peat layer thins out, and under the greater part of the town borings give blown sand superimposed on clay and marl.

I am indebted to Mr. Glaisher, F.R.S., and Mr. Joseph Baxendell, Meteorolgist to the Town Council of Southport, for the following meteorological data. The observations from which these conclusions are drawn embrace a period of eight years.

The mean annual temperature for that term of all the meteorological stations given in the Registrar-General's returns equalled 48°·4. For lat. 53° 54°, 54° 55°, it equalled 47°·0.

Southport is situated in lat. 53° 54°; its mean temperature equals 47°·2.

The mean daily range, a matter of extreme importance for persons in delicate health, equalled for all stations 14°·7 for lat. 53° 54°, 54° 55°, the range was 13°·0.

Southport has a mean daily range of 11°·5.

The annual rainfall of all stations equalled 33·9 inches on an average. The annual rainfall of stations lat. 53° 54°, 54° 55° equalled 37·6 inches. The annual rainfall of Southport equalled 37·7 inches.

At all the stations the wind direction was as follows :—

North and East winds blew on an average..... 147·9 days per annum.
South and West ditto..... 210·1 „ „

At Southport

North and East winds blew on an average..... 120·1 days per annum.
South and West ditto..... 243·7 „ „

The excess of south and west winds over north and east was 62·2 days for all stations.

In Southport the excess of south and west winds over north and east was 127·7 days per annum.

I have, from data afforded me by one of the leading men of business in Southport, made a calculation by which I find that the density of the population in Southport is barely nine persons to an acre. The density in 22 large towns in England and Wales in the Registrar-General's Annual Report give 38 persons to an acre.

The rateable value of Southport makes it nearly the wealthiest town for its size in England.

The experience of medical men and that of many sick persons confirms the belief that the climate of Southport exercises a very favourable influence upon bronchitis, pulmonary phthisis in its earlier stages, cardiac disease, and some forms of renal disease.

The significance of the foregoing facts seems to me to be as follows :—The Southport of to-day is a very wealthy town, especially laid out as a health resort, possessed of ample air spaces. The proportion of nine persons to an acre is out of all count below the proportion for towns of like size, so that none of the ill effects of over-crowding can possibly be operative here. The town is so situated that her wide streets are constantly ventilated by south and west winds. The climate is very

remarkable for its equableness. Although the rainfall is very slightly in excess of the average, the porous nature of her soil makes the moisture at once disappear, leaving the surface dry. These conditions would, *à priori*, render it likely that Southport would be a favourable place for the treatment of various diseases, while the experience of the past has proved that it *has* been so; and that it should be a healthy residence. The experience of Southport's present condition does not bear out this reasonable expectation. Numerous complaints of residents, fortified by the mortality statistics of the town, prove that the salubrity of the climate of Southport and its health standard have not, for years past, and are not now, what her salubrity and health standard should be. I would, in the remainder of this paper, demonstrate the causes of this evil state of matters, which I believe to be entirely remediable.

A new drainage scheme was designed for Southport by an eminent and well-known engineer, and was opened in 1878. The gradients obtainable in Southport vary from 1—1,500 to 1—5,000 and the outfall is 4½ miles from the town. I do not wish to enter into a detailed account of this system, but I would remark that the principal feature is the smallness of the gradients and consequent slow rate of the sewage stream. The whole system is tide-locked twice in twenty-four hours. The ventilation of the sewers is effected by grids opening at short intervals in the streets. Through these grids sewer gas passes in large quantities, and makes its presence known by very disagreeable smells in the streets, and even houses of the town, which it enters through the windows. An attempt has been made to increase the ventilating surface provided for this drainage system by the erection of ventilating pipes at the sides of houses. This is, I think, a method of very questionable advisability, as cases have been known of illness caused by sewer-gas sucked from the ventilators down the chimneys of houses to which they were attached. In the belief of the inhabitants, which I hold to be well founded, these drainage emanations are the causes of numerous disorders of health, of head-ache, sickness, depression, and so on. The universal existence of these smells is substantiated by memorials, numerously signed by inhabitants, from all parts of the town, and has been publicly admitted by the Corporation of the town and by Major Tulloch, R.E., Inspector of the Local Government Board, who at a recent inquiry at Southport held it unnecessary to call witnesses to prove an admitted fact. Such an admission carries with is a great deal. It implies not only that very frequently, and more especially at certain states of the weather and tide, sewer-gas passes in very large quantities

out of the drain, and makes its presence known by evil smells; but that at all times the atmosphere of the town is tainted with sewer emanations. Sewer-gas may be present, and do harm to health, though its quantity is inappreciable to the sense of smell, and because certain sewer-gases are inodorous. The conditions in such a drainage system are always present for the formation of noxious gases and their discharge.

The reputation of Southport has, since the opening of the drainage system, widely suffered in consequence of these smells, and certainly the value of house property, and the demand for lodgings has, for the last five years, been lessened. In so far it has been established that Southport is not what it ought to be as a health resort, because the inhabitants and visitors are disgusted, and believe they are made ill by drainage smells in its streets. And I believe medical opinion will support the belief, that not only do sewer gas emanations cause attacks of illness, sometimes of the worst kind, but even when not acting with such virulence as to cause distinct illness, a sewer-tainted atmosphere lowers the general tone of vitality, and tends to embarrass recovery from all forms of disease. If this statement be true, certainly the admission that sewer gas is largely present in the air of a health resort is a very serious admission, and will go far to tend to destroy its reputation as a health resort.

For some years past, Southport has suffered from her prosperity; built rapidly on a site which, with its intrinsic advantages also, was in its nature subject to certain dangers, adequate provision had not been made for her drainage as the number of her houses increased; and when, in 1877–78, the present system of drainage was devised, the great flatness of her site entailed sewering difficulties which I think I am justified in describing as insurmountable in the *then* state of sanitary engineering science. The cost of overcoming these difficulties would have been so great that Mr. Mansergh himself stated that the revenues of Lancashire would not pay for those pumping arrangements which alone could be hoped to remedy the difficulty. I have spoken of the town before the inauguration of the new drainage, and then described the difficulties attending it, because I wish, by adducing mortality statistics for both terms, to shew that the wide-spread belief that the sanitation of Southport has not been improved by the present system of drainage is well founded. I shall very shortly speak of the mortality statistics of Southport before and after 1878, the year of the inauguration of her present system of drainage.

The position I now wish to establish is, that the mortality statistics of Southport show that her standard of health has not

been, and is not now, what the health of a professed health resort should be, and that the present system of sewerage inaugurated in 1878 has not materially improved that standard.

I hold the health of Southport has not been in the past, and is not now, what the health of a professed health resort should be, because if it were, her death-rate would compare favorably with that of other places from which people would come to her in search of more favourable health conditions. It does not so favourably compare. And again, if the health of Southport were what the health of a health resort should be, her death-rates would range on a level with those of other health resorts, which they do not.

There is in the Registrar General's reports a table which gives the gross death-rates of 50 large town districts. Now these large town districts have large mixed populations, numbering, on an average, 50,000 persons; and these towns have been built through many years with no special reference to sanitary requirements; and they have no pretensions to be considered health resorts. They, in fact, represent the kind of place from which people in feeble health come in search of the more perfect sanitation, which a health resort should afford. On comparing the death-rates of these places with the rates of Southport I find that for the term 1876-1878, on an average, every year, out of 50, 35 such places had an average death-rate of 20·1, as compared with 23·3 for Southport, and their average population was 55,126, as compared with 27,148 for Southport. For the term subsequent to the new drainage 1879 to 1882, 19·1 of these towns had a death-rate of 17·6, as compared with a death-rate of 19·4 at Southport. So many of these places had a death-rate, absolutely less than that of Southport, but besides these, many had a death-rate very slightly above that of Southport for these years.

I think, taking into consideration the larger population of these places, and the conditions of life in them, a comparison of their death-rates with that of Southport tells strongly in support of the assertion that Southport did not before 1878, and does not at present, merit the reputation of a health resort in relation to them.

Nor do the death-rates of Southport range for the terms 1876-78, 1879-82 on a level with the rates of other health resorts. Thus I some time ago addressed a circular to the medical officers of all watering-places mentioned in the Registrar-General's second quarterly return for each year. I received information more or less perfect from 19 of these. On comparing the average of these death-rates they were all considerably less than the corresponding rates for Southport. I specially quote the rates for the second term 1879-82 after the

opening of the new drainage: Average population of 12 watering-places 20,387, average death-rate 17·1; average population of Southport 32,191, average death-rate 19·4. Lest it be said that the smaller populations of the health resorts accounted for their smaller death-rates, I quote the following: 1879 to 1882, Hastings and St. Leonards, population 42,256, death-rate 16·7; Torquay, population 24,765, death-rate 15·8; Cheltenham, population 46,844, death-rate 17·5; Scarborough, population 30,484, death-rate 18·7; average death-rate of these four watering-places, 17·1. Since these statistics were calculated by me, the *London Medical Record* of July 15, 1883, has published statistics which enable me to compare the gross death-rates of 12 more watering-places for the term 1879 and 1882. Their average gross rate equals 15·1, as against Southport 19·4. The standard of health of Southport, as shown by these death-rates, was considerably below the average standard of English health resorts.

I think that I have proved that the health of Southport has not been in the past, and is not now, what the health of a health-resort should be, because its death-rates compare unfavourably with—first, those places from which persons in search of better health conditions would come to it, and because its health standard, as shown by its death-rates, compares unfavourably with the health standard of other health-resorts.

I would now adduce some facts to show that the new system of drainage has not improved the health of Southport. Had it done so, we might have expected to find a marked fall in the death-rate of the town after its inauguration. The new system came into full operation at the end of 1878. The death-rates for 1877–1878 are 22·8, 22·8. The death-rates for 1879–1880 are 20·8, 22·9. The average of two years after the drainage year give a drop of 1·0, a small improvement indeed, and even this is explained on the plea of a drop in the general death-rate of the country. The same calculation gives a drop of ·8 in the England and Wales rates, and a drop of ·7 in the average death-rates of all the 50 large town districts. There are other points I should like to enter upon, but time and, I fear, your patience, both forbid a too long discussion. I should only like to say that, though in 1881–1882 the death-rate of Southport dropped, its drop took place, to a great extent, in the death-rate list of infants, and was coincident with a very marked drop in the birth-rates.

I now enquire what light a consideration of the death-rates of the drainage diseases, par excellence, *typhoid fever*, *diphtheria*, *scarlatina*, throws upon the question of benefit or no benefit to Southport since the new drainage system. I find as follows:—

Typhoid fever in 1879 a drop of ·43 indeed occurred, but then I also find that in 1877 a drop of ·78 occurred, which could not be due to the new drainage, which was not then laid. I do not, therefore, see why the drop in 1879 should be attributed to its good effects, and not to the unknown influences which produced the drop in 1877. And although the death-rate dropped in 1879 it has since shown a distinct tendency to rise, as the new drainage might be supposed to make its influence felt following the sequence for 1880, 1881-82, of ·22, ·31, ·17, and for the first half of 1883 ·28. And this is the more significant because the corresponding rates for England and Wales have been ·26, ·18, ·20, giving an average for the term of ·21 against ·23 of Southport; while for the first half of 1883 England and Wales gave a typhoid fever rate of ·19 as against ·28 Southport.

The diphtheria death-rate gives still more unfavourable testimony as to the effects of the new drainage. For the years 1879, 1880, 1881, 1882, the rates are ·06, ·09, ·18, ·20: it has steadily risen. And though it dropped in 1879, still that cannot be attributed to the beneficent influence of the new drainage because in 1873, 1874-75, 1876, the sequence was ·00, ·00, ·04, and ·18, before the drainage was laid. And also the average death-rate for England and Wales for the term of 1879-82 equalled ·11, Southport ·13. The scarlatina death-rates also give unfavourable testimony as to the effects of the new drainage. Formerly there was little or no scarlatina in Southport, and since 1877 it has been markedly present and has steadily increased:—

1876	1877	1878	1879	1880	1881	1882
·00	·07	·51	·16	·12	·34	·44

In 1882 the Southport scarlatina rate, ·44, nearly equalled the England and Wales rate, ·51.

I cannot compare the fluctuations of these death-rates as they occurred for the above term in large town districts. I cannot gain the data as far as my search has gone. I content myself with giving a summary of the number of deaths which on an average occurred in the health resorts, quoted by me in my pamphlet on the sanitary condition of Southport, and in Southport for the term 1879—1882:—

	Health resorts. Average totals.	Southport. Totals.
Typhoid fever	14	25
Diphtheria	3·2	18
Scarlatina	12	35
	29·2	78

I think that, as far as the death-rate of typhoid fever, diphtheria, and scarlatina, the sewerage diseases par excellence show, certainly the new drainage system of Southport cannot be said to have improved its standard of health, and its establishment certainly has not been followed by such a marked improvement in these mortality returns as to place Southport on a par with other health resorts, or to justify the allegation that her health standard is what the health standard of a health resort should be.

And in conclusion I would submit that all these mortality statistics I have given, whether they represent the gross death-rate or the rate of special diseases, establish my allegation, *i.e.*, they do not present any proof that the new drainage system has benefited the town, but they indicate a contrary conclusion.

There is another danger which partly threatens the sanitary condition of Southport and its reputation as a health resort, that is the high level and impure condition of its subsoil water. On an average the subsoil water is at a level in Southport 3½ to 4 feet below the surface, and to my own knowledge at certain times it renders quite wet, and even stands on the floors of the cellars of houses in various parts of the town. Ten specimens from various parts of the town, and from the cellars of houses have been analysed by Mr. A. Smetham, F.C.S., and on a consideration of the total results obtained he pronounces the subsoil water to be so contaminated with sewage matter as to be dangerous to the health of the inhabitants; certainly a complete drainage scheme for Southport ought to make provision for lowering the level of its subsoil water.

I would venture to submit that in the foregoing remarks I have established that the town of Southport naturally possesses sanitary advantages, which would entitle her to take place as the leading sanitorium of the North of England, and especially of the great mercantile and manufacturing towns of Lancashire and Yorkshire. I have established that a great danger threatens and has threatened her qualifications as a health resort in the difficulty of draining her site, and in the inadequate system of drainage now laid down, which does not and cannot in the nature of that site, quickly, safely, and inodorously convey the sewage away from the town, and does not deal with the very important matter of lowering the high level of its impure subsoil water. That I may clear myself from the imputation of having demonstrated an evil for which I can propose no remedy, I would close these remarks by stating my belief that Mr. Isaac Shone's system of pneumatic drainage would solve the drainage difficulty at Southport, and places labouring under the

like disadvantages of flatness of site. In doing so it would relieve her of her one great sanitary disability, and would set her free to rise to her natural place of a leading sanitorium of the North of England.

Dr. A. CARPENTER said it was a pity Dr. Wright's paper was not read at Southport. They should not as an Institute take up their time so much with details of places at a distance as with principles.

Professor H. ROBINSON, M.I.C.E., said that as they had not the benefit of the presence of the engineer, they could hardly go into the matter of Southport. The gradient of the sewer was very flat, and it would be necessary to make an artificial flush. He would like to know what had been done with regard to the house connections. Could Dr. Wright tell what were the arrangements made for the protection of the inhabitants from the entrance of sewer gas from the main sewers? Some of the most perfect systems of sewers were liable to develope sewer gas, but the mischief occurred when it was introduced into the houses. He thought they ought not to assume that the evil was attributable to sewerage *per se*, because he would like to have the presence of the engineer who designed the sewers, to know what were the gradients, and what were the connections with the houses. If he found that a flat sewer could not be avoided, he would resort to artificial flushing. He did not wish it to go forth that the Congress assented to the idea that the mischief in Southport was attributable to the system in operation. He also disapproved of any addition being made to a paper after it had been sent in and accepted, as it might lead to a longer discussion than the paper itself.

Captain DOUGLAS GALTON, R.E., C.B., also held that it would be impossible to discuss the question of Southport, because they had not a description of the drainage, nor was there anyone present to speak on behalf of the system. It was perfectly true that a discussion had been going on at the meeting of the British Association at Southport upon the system of drainage, at which discussion it had been reported that the engineer would be present. He would only observe that the real difficulty with the drains arose from their flatness and the town being only a short distance above the high water level. The whole district was entirely of sand, which often blew into the drains, and, choking them, created great difficulties. There was thus a continual need of flushing the drains, and one contention was that adequate means of flushing had not been provided.

On "Hygienic Gymnastics in the Dressing-Room," adapted to persons of all ages, by the CAVALIERE SEBASTIANO FENZI, Florence.

All for the soul and naught for the body—envelope destined to be the food of worms.—So people said some centuries back when ascetic ideas predominated; and there is no doubt that this notion, which no one combated and which all considered, or affected to consider, as an absolute truth has exercised, during the last three hundred years, a pernicious influence on the welfare of our species.

At the beginning of the present century, however, there arose a powerful voice in Germany calling on all German youth to cultivate the discipline that can best educate the body, and enable it to reap all the advantages to be derived from health, strength, robustness, agility, and æsthetic deftness and beauty, and proclaiming further that physical energy gives a corresponding impulse to the intellectual and moral faculties.

It was the strong voice of Frederick Louis Jahn who, inspired by love of his country, and full of faith and enthusiasm, preached the absolute necessity of physical culture in order to succeed in rending the chains with which the triumph of the French arms had then shackled the German Fatherland. His words were understood, and thousands of his countrymen quickly acquired fresh vigour, the effects of which became evident even then, and have ever since—as recent events have eminently shown—told in favour of the greatness and glory of the whole nation.

A race heavily built, devoid of grace and elegance, with joints large and vulgar, a race naturally inert and sleepy, inclined to laziness and drunkenness, is now transformed into a nation of men well built, lithe and strong, and in full possession of energy and valour. This metamorphosis is, we may say, entirely due to physical training, to which, as I have said, Germany has during this century been continually devoting her most careful attention.

This conspicuous example proves of itself, and in the clearest way, the fallacy of the maxim we have above quoted, and must convince everyone that in practical life the body demands its due share of care and attention, and that in order to be adequately equipped for the battle of life, it is not enough for the

intellect to be properly cultivated, but our physical nature must be equally attended to and brought to a high degree of excellence; and this is to be attained only through a rational method of well-selected exercises.

In the course of some remarks which I had occasion to make last year in Naples to a large audience, chiefly composed of gymnasts, I said, "We must confess that in our modern civilization—a civilization we so pride ourselves upon—there exists a great gap, namely, the culture—the adequate training—of our physical being. The elegance displayed in dress, which soothes our vanity, shows that the true wish would be to have our body in a state of æsthetical perfection. And that is, indeed, what we all ought to attain to, if hygiene and gymnastic education received the attention that their true nature and importance entitle them to."

I have repeated these words as they appear to me to contain an idea which it would be well and desirable should not be forgotten.

In this world of ours the existence of every human being is centred in the bodily organism, and by endeavouring to make it thrive and flourish until it reaches the highest standard attainable, we shall undeniably thereby, and thereby alone, be enabled to place ourselves in possession of that exalted state of well-being which we by nature were destined for.

I do not, therefore, understand how in the light of our century this idea, which seems almost a truism, should but with difficulty have penetrated into the minds of those shrewd and clear-sighted men who in our country have taken up the complex question of modern Educational Science.

Among our best writers on Hygiene we reckon Senator Paolo Mantegazza, who by his familiar style has succeeded in rendering popular a large number of ideas and precepts, which disseminated all over the Peninsula, have created a sort of appetite for the knowledge pertaining to this important subject.

In one of this writer's works I have found a phrase which in my opinion deserves particular attention. "If I could condense," he says, "all Hygiene into one single precept—the most important of all—I would say, *move about as much as you can in the open air*."

There is no doubt that this maxim is pefectly correct, and if those who are opposed to the idea of submitting to any rational method of gymnastics were only to follow out the above rule, I believe that, by itself alone, it would be productive of appreciable advantages, and promote health in all those who systematically conformed to it.

It is a fact, however, that even to this very limited suggestion our present generation, young and old, show themselves averse, not having as yet realized the fact that in order to provide for our individual health, a certain amount of toil and tenacity of purpose is requisite. People generally believe that by merely guarding against intemperance they discharge their duty as trustees of their physical existence.

I wish it were possible that all the inhabitants of our Peninsular could simultaneously receive a powerful shock, such as would compel them to open their eyes to understand and appreciate the utility and paramount importance of the special care that our organism requires, and that, once for all, they were to lay aside the carelessness to which they have for centuries past accustomed themselves, convinced as they are that no reasonable objection could be raised against such abject inertness.

And if this actually came to pass, I feel perfectly satisfied that in the course of a few summers a thorough change would be observable in the aspect of every individual.

Who is there that in passing through the thoroughfares of our chief cities does not experience an intense feeling of pity and disgust in witnessing so many deformities, so many sickly-looking creatures, so many human beings stunted and degenerate, showing to what a state of humiliation it is possible to reduce the human frame, which we say, forsooth, is made after the image of the Ruler of the Universe! How I wish that my voice had the power to reach all my fellow countrymen, and the eloquence to persuade every one to profit by that which a life-long experience has taught me, and which I am now endeavouring to point out with modest words, and with but little hope of being seriously listened to.

Still I will not allow myself to feel disheartened, and shall have my say, convinced as I am that if the philanthropic work I am devoting myself to, meets with but little result, it will still be a spur to others more gifted than myself to try with better arguments to attract general attention to this important matter.

It is but fair to state that we could with satisfaction enumerate many superior minds which have tried to offer to the public the fruit of their reflections on this subject, but it is to be regretted that such writers seem chiefly desirous of showing off their notions regarding Physiology and Medicine, so as to obtain favour with people versed in these studies, without reflecting that the public in general would prove indifferent to their learned disquisitions, rather beyond the depth of the average of readers. I will not say that they have not done something good and note-

worthy, but in this manner it is not easy to attain our object, which is to render hygienic gymnastics popular.

After these preliminary remarks I may at once enter upon the subject of this paper.

It is my firm belief, then, that for every human being the education of the body is no less requisite than the education of the intellect and moral nature. And certainly our Government showed that it held the same opinion when, by special laws, it made physical education obligatory for both boys and girls throughout the kingdom. Still, if the efforts of all those who have at heart the culture of our material being are not everywhere manifest, in order to second the wise injunctions of our Government, I fear that very shortly even this semblance of bodily culture will gradually dwindle down and become a dead letter; and this I say notwithstanding the fact that many teachers of both sexes (chiefly from the Normal School of Turm) scattered in the many cities throughout Italy, discharge their duty in this respect with exemplary zeal and self-sacrifice. It is with this conviction, and in order to discharge what I believe to be my duty, that I have been led to write the present paper.

I do not limit my recommendations and advice to the young, but I address myself to all those who will lend me a willing ear, whatever be the age they have reached, being desirous of showing them that there is an easy way of keeping up their health and strength—of, in short, taking a new lease of life.

The method I am about to point out is the one which I have myself practised with perseverance, and which has prevented Time from diminishing my robustness or tampering in the slightest degree with the prosperous state of my health. Allow me to lay modesty aside for a moment and to say that, although I am now in my sixtieth year, I feel, and am, still young. This phenomenon, if I may be allowed to call it so, is not a novelty, however, for in the olden time when Greece had reached the sublime altitude of her civilization, the Macedonian army possessed a phalanx which outrivalled every other for solidity and hardihood, and which proved itself the most unflagging in bearing up against the fatigues of a campaign—namely, the phalanx of the *Argyrasps*, consisting entirely of men who had passed their sixtieth summer, and wearing as a distinctive sign a silver shield—whence their name.

If such men existed in that period of the world's history, there is no good reason why they should not also be obtainable in our own days.

I am fully aware that objections can be raised, there being but few who would submit to the military discipline of ancient

Greece in order to obtain such a result. To this I answer, that no one need be alarmed; I ask only what everyone can readily and easily concede. I will even go further and say that although I may prefer the rules and the method I am about to indicate, everybody may, after taking them into consideration and testing them, diminish them, augment them, or alter them according to individual predilection.

It is evident that if we find it absolutely necessary to exercise daily to a certain extent our intellectual faculties, in order to maintain them at least at the level they had reached through a wise and liberal education in our youth, and thus prevent our losing the fruit obtained, we are bound to continue in a similar way certain bodily exercises which experience points out as fitted to promote and keep up that just equilibrium between mind and body necessary to ensure that enviable state of feeling arising from the prosperity of both, and enabling us to better accomplish our duty in the struggle of life.

This maxim would appear to be an undeniable truth—almost an elementary one, and yet how few there are who regulate their mode of life by it? Some maintain that a walk every day is more than sufficient to secure good health, and there is not a doubt that there is something to be gained by a constitutional walk. But allow me to draw a comparison. A savage supposes he is sufficiently dressed if he wears a short piece of linen round his waist; but in our part of the world where civilization is far advanced such rudimentary clothing is not enough, and everybody feels it a duty to devote a good sum of money every year to the purchase of raiment suited to his condition in life. Well, my meaning is no doubt already understood.

To say that a short exercise in the open air is all that is requisite to ensure the healthy state of our entire organism, appears to me not dissimilar to the span of linen which the savage persists in believing is all that is needed in the way of dress.

Fortunately, in the present century of great progress, in which not only new ideas crowd in, but some of the old ones are being revived as having been unjustly and unwisely abandoned, there is among the latter this one which calls upon us to direct our best attention to our corporeal well-being; and thus in some of the nations north of the Alps the custom prevails of promoting physical health by daily exercises which are not limited to the promenade above mentioned. Among the Germans, and much more so among the English, there are both men and women who illustrate this revival with ideas similar to those held by the Greeks and Romans of old.

I shall not enumerate these ideas for fear of rendering my

paper too lengthy; but shall, without further remark, place before the reader as succinctly as possible what I myself, an old stager in point of bodily discipline, have practised for many years as a method of life fitted to render not only less painful but more gay and happy our short journey through this world from the cradle to the tomb.

The physical inertness to which I had abandoned myself towards my thirty-fifth year was the cause of my becoming subject to sundry ailments which it would be useless to mention here. It then struck me, and very forcibly, that the body inexorably demands the amount of care that is due to it; and after reflecting upon the matter I drew up a programme of daily life to which I have not only always adhered since then, but which I have gradually succeeded in extending and improving, and which judging from the effects at the time I now write, I have deemed not unworthy of being largely known among my countrymen.

And yet before bringing it forward I must express one last idea so as to explain more clearly what the true reasons are which have prompted me to write this paper.

Those who have never directed their attention to physical discipline are easily led to exaggerate the methods followed by others who cultivate such exercises. In the minds of most people we gymnasts are supposed to be something akin to English *clowns*, fond of turning somersaults, and ever on the point of breaking our necks. I, therefore, beg to announce to all who may chance to read these few pages, that if such be their idea on the subject, great will be their supprise when they find how simple the exercises are through which our body is brought into possession of all that is required for its health and prosperous condition.

The foremost precept of all is *perfect cleanliness of the whole body*. Whoever is desirous of ennobling his material being must acquire this precious habit. Hygiene has not a rule more golden than this. I have always felt persuaded of this, and I beg leave to say that besides all the ablutions of early morning, and my extra toilette before sitting down to dinner, I have always been in the habit, without ever departing from it, however late the hour, of not lying down in bed at night without enjoying the sensation of supreme satisfaction (which is in everybody's power) of feeling myself perfectly clean from head to foot by washing my face, ears, and hands, brushing my teeth, and going through all the other ablutions, not forgetting the feet, for which by the way special care is particularly needed.

The second rule, which others might perhaps put first, and judging from its efficacy it might truly deserve to be so, is

moderation in everything—that is *Temperance*. Nature, by some erroneously looked upon as often a heartless stepmother, ever indicates this most clearly and eloquently, and I need not expatiate on the subject.

Having pointed out the above fundamental principles, I shall now begin to enumerate all that experience has taught me to be the daily programme necessary for promoting the health, the well-being, and the happiness of my material being.

In getting up of a morning, whatever be the season of the year, and without fire in my bedroom or in the room next to it (my dressing-room), I take two brushes and, besides passing them vigorously to and fro on my head, I use them to brush most briskly my neck, chest, shoulders, arms, abdomen, legs—in short every part of my body, and for these different offices I have four brushes. I then go through all the exercises which in gymnastics are called elementary, namely, four different exercises of the neck, five of the arms, four of the back and trunk (which imply sundry movements of the spine), and finally, five different exercises with the legs. (Of all these exercises I shall offer a minute description further on.) After this, I hang by the right hand to one of two iron brackets firmly fixed in the wall about seven feet from the ground and a foot and a half apart. I thus support the whole weight of my body for a few seconds, and then repeat the exercise with the left hand and arm. I next hang by both hands to the two brackets, and pull myself up so as to touch the supports with the top of the shoulders, and repeat the movement several times —that is, as long as my muscles allow me to do so without feeling tired.

This done, in order to give the heart time to resume its normal pulsations, I wash—in cold water, of course—my hands, face, ears, feet, and teeth, not forgetting the ablutions under the armpits and the inner parts of the thighs. Immediately after this I place myself in the middle of a large tank made of tin, and, with a large sponge well soaked in cold water, I take my bath—which I might call a "shower bath"—squeezing the sponge on the back of my head and passing it over my whole body. I repeat this three times, soaking the sponge each time in a large basin of water close by.

I then dry myself as the gladiators did of old—not, indeed, with a shell, but with an ivory paper-knife—in order to accustom the body to remain for a few minutes thus drenched without any harm accruing. This done, I rub myself briskly all over with a rough towel, and when perfectly dry I "groom" myself again with the brushes and then return to bed where the reaction takes place in the most favourable manner. And in

order that this re-action should the better be effected, experience has taught me that it is well, even in this recumbent posture, to go through a series of movements with the legs, feet, thorax, spine, arms and neck; and these movements will also be found specified further on.

When I have thus gone through the first part of my programme I take an early breakfast in bed, consisting of a cup of tea and a slice of bread and butter, and for half-an-hour I remain in bed reading my favourite newspaper.

Then for the second time I get up and use my brushes, passing them briskly over the whole body from head to foot.

And here I do not think it out of place to state what I habitually do, although, properly speaking, this has nothing in common with gymnastics.

Some years ago I happened to read in the autobiography of an English admiral that he was in the habit of rubbing his head, face, and neck with a smooth round piece of ivory finding that this friction had a salutary influence, not only on the integument of the skull and on the bulbs of the hair, but contributed also to give tone to the brain itself. He also added that in rubbing every part of the face the following effect was produced, namely, that it prevented those fatty substances which spoil the form and appearance of the features from lodging between the skin and the muscular tissue. I cannot positively affirm that such is really the case, but I certainly believe that it has a tonic power, exciting as it does in all parts so rubbed a greater amount of vitality, which is always to the advantage of correct æsthetic shape. As regards the neck, and especially the throat, it is a fact that this tends to promote more vigour and health, and this I can affirm from my own experience.

But to return to my programme of Physical Education. I am in the habit after this salutary friction, of practising jumping, that is, I leap up several times on a piece of furniture made for the purpose, without taking a run but making standing jumps. The piece of furniture in question is only a square wooden box for keeping fuel in, two feet and a half high, with a cushion fitted to it on the top.

Sometimes, instead of jumping on this box, I place a cane on the top of my clubs standing about two feet apart, and jump over it several times, always increasing the distance of the point from which I leap. This exercise is among the very best, because, besides strengthening the muscles of the legs, it tends to effectually keep up the elasticity and agility of the whole body.

Next comes the exercise of the clubs which I have reduced

to only six or seven movements, and of which I shall speak more particularly in the proper place.

After this exercise, I wash more carefully my face, ears, and hands, and perform the other ablutions, besides which I wash my feet, brush my teeth, and pare the nails of my hands and feet when necessary.

And now comes an exercise which will naturally rather astonish my readers, but which will no doubt be highly appreciated by all those who do not scoff at the culture of our material being—I mean *running*—an exercise perhaps superior to all others as regards the advantages to be derived from it.

In the three rooms which I occupy, the distance between the two farthest corners of the first and third is twenty-five paces, so that in running to and fro we may call it fifty paces. Long habit has enabled me to go over the whole space fifty times at a running pace, without experiencing the least fatigue, in from ten to fifteen minutes, according to the speed that I feel disposed to adopt.

Having finished running, as it is not prudent to allow the body to subside all at once into perfect rest, I continue to walk over the distance for two or three minutes, gradually diminishing my pace until the heart has regained its normal pulsations.

Without going back to the history of times long gone by, I am desirous of letting the reader know that we have an example in our own century of the manner in which this exercise is appreciated by the one nation which is, as I believe, the best qualified to establish the rules of all athletic practices—I mean the English. In the two great Universities of Oxford and Cambridge, the students who are chosen as champions for the yearly regatta, put themselves into training for several weeks before the event, and in order to do so properly they have found that running is necessary, that being one of the most, or, indeed, *the* most invigorating of all exercises, so that besides rowing they every day practice also running.

This sort of training may seem excessive to us, little used as we are to these healthy and manly contests, when I say that as regards running as a part of it, the champions of both Universities accustom themselves to run for a whole hour without feeling exhausted, which shows indeed the strength and robustness they have acquired.

Still if in the programme I have above indicated ten or fifteen minutes' running should appear far too much to any one desirous of making a trial, it will be easy to diminish the time to be thus employed, and then endeavour to increase it gradually, say from one minute upwards, so as to reach the limit given,

and then again lessen it, it being a law never to be infringed that we must not practice any one of the above exercises to such an extent as to induce fatigue and prostration. By beginning by very little, and gradually increasing the exertion, the body easily acquires strength and energy sufficient not to feel at all fatigued in going through such exercises as would at first have completely exhausted it. But with all this I do not maintain that it is at all necessary to pass one's life in "training," as the above-mentioned English youths do for a short time.

In making all these remarks I naturally trust to the good sense and discretion of the individual, reminding him meanwhile that the rules indicated are not meant to render the body stronger than just what it needs to be in order to enjoy robust and prosperous health, for to go beyond that would be contrary to my intention.

The last two exercises I go through are the following: First. Placing two chairs back to back, about two feet apart, I use them as parallel bars. Raising my body off the ground, with my hands resting on the top bars and my arms straight, I bend these so as to sink gradually until my knees reach the ground, when I again raise myself up. I repeat these movements up and down five or six times, and even oftener if I feel so disposed. Second and last. I go through an exercise with the weights, invented by Signor Alfredo Mengozzi, the well-known gymnastic master in Leghorn. These consist of iron discs, each having an opening from the circumference to the centre, which allows of their being placed round a vertical axis one above the other, according to the weight required. Of these there are two groups, one for each hand, and each of the groups is attached to one extremity of a cord, which, passing through a pulley at the end of a bracket, terminates in its other extremity in a handle in the form of a stirrup. The two brackets are of iron, and are fixed in the wall about 5 feet from the ground, and about 20 inches apart. I use these weights for one exercise only, which I repeat several times, with each arm alternately. I shall explain this exercise more fully in its proper place, and now merely observe, for the purpose of showing the result one may arrive at, that having begun with a weight of 20 kilogrammes (44 lbs.) for each arm, I can now raise just double the weight, with the left arm as well as the right.

After this I dress and go out to my daily avocations, with my mind as clear and with as juvenile an exuberance of life as if the sixty years which have whitened my hair had stopped at thirty—a fact!

I well understand that, impressed with ideas still prevalent, many will feel disposed to shake their heads and smile almost

with pity, feeling satisfied that to enjoy health and live with physical comfort, there is no necessity to go through all this fatigue. I am likewise convinced that any display of words on my part in order to persuade any one that the practical application of these principles of Physical Education is productive of most desirable and valuable effect, would be a fruitless task.

And be it so! I shall limit myself to simply enumerating the different factors which mainly contribute to our well-being in this life—health, robustness, beauty and elegance of form, activity, and energy. By following my method any one can at any period of his life—and be it remembered that it is never too late—gradually obtain possession of all—or almost all—of these valuable qualities.

I leave it, therefore, to you to decide whether it is worth his while to make a trial.

Moreover, I beg those who should feel disposed to make a trial, to arm themselves with one indespensable virtue, *Perseverance*. In order that these exercises, beginning by very little and gradually increasing so as to include the whole programme, should become a well-rooted habit, and require no strain to practice them, but command, in fact, our predilection so that we cannot cast them aside, many weeks and months, and perhaps years, must elapse; but this ought not to discourage the wise, if thereby a benefit can be secured not only to ourselves but to the whole nation and ultimately to humanity at large.

It is a source of great satisfaction to me to think that a man, whose great and refined intelligence was an object of pride to the commonwealth of the United States of America—William Cullen Bryant* unequalled both as a poet and orator, should have practised a method similar to mine in order to protect and promote his health, and that he should thereby have enjoyed to a great age a flourishing state both of physical and intellectual well-being. He, as an intimate friend of his, Mr. J. Bigelow, has told me, devoted two hours every morning to these exercises, including the time required for the cold bath. I am satisfied with the hour which I occupy in going through the whole of my programme, nor do I find it necessary to prolong it beyond this limit. Many persons, however, may find after fully testing my

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* Bryant died four years ago in his 83rd year. Fresh and still young in body and mind, he, after having delivered a speech of two hours to an immense crowd of people, went on foot to a friend's house two miles distant, on a sultry day, and without any protection from the scorching rays of the sun. The consequence was that he received a sun-stroke, of which he died. Bryant and Longfellow have been the two great poets of the Great Republic, and by many the former is preferred to the latter.

method, that they can derive greater benefit in imitating Bryant's example, whilst others will think it advisable to content themselves with what I do—which, to say the truth, is not little. I will add that every one will do well, whilst accepting my ideas, to choose and adapt to his own case the exercises for which he may feel more disposed, when after a whole year's experience he will have been enabled to judge properly—I mean to judge of their *efficacy*; because if he were too soon either to lessen them or augment them, he might be led to do so through mistaken motives—either from laziness, or a desire to obtain too much.

In the last place, I beg to remark that by virtue of this hygienico-gymnastic programme everybody can acquire for himself, and to a great extent also for his offspring, a legitimate title to physical nobility, which in our modern existence is not of less importance than a similar title derived from blazonry or wealth, especially if united to nobleness of heart and intellect, without which, indeed, all kinds of titles and honours are alike vain and worthless.

Detailed Explanations of the above-mentioned Exercises.

Let me first of all indulge in a few remarks about the frictions made all over the body with brushes.

Many persons experienced in the medical art, who have studied the effect of this action upon the skin, look upon it as something hygienic, already well known and largely practised by the English; nor do they hesitate to recommend it as healthy, not only on account of its tonic effect upon the skin, but also because of its efficacy in benefiting the muscular tissue and giving fresh impulse to the circulation. A young and highly-talented physician has investigated the salutary action of this kind of friction, and has led me to hope that he will make it the subject of a lecture, and publish it for the benefit of the public. He has told me that from experiments he has already made he is disposed to adopt brushes made of iron bristles, and I am persuaded that he will offer satisfactory reasons for his preferring capillary wires to the common hog's bristles. Meanwhile those who are disposed to try this sort of "grooming," will do well to begin with soft brushes before making use of such as I employ, which are made of Russian bristles, and are exceedingly rough. I moreover suggest that they should pass them vigorously over the chest and abdomen, between the thighs and all over the legs, not forgetting the feet, which latter being all day in durance vile within the boots, are really

in need of being forced into greater vitality. I also recommend the passing of the brushes several times round the neck, this also being a part of the body that deserves special attention; nor must the arms and arm-pits be neglected, nor the shoulders, nor the whole course of the vertebral column.

Elementary Exercises.

These exercises are usually gone through with a small weight in each hand, called *haltère* in French and *dumb-bell* in English. But as to this every one will do as he pleases. I should feel disposed to recommend their use, because it is a fact that, without requiring much exertion, they tend to give strength and robustness to the arms.

These elementary exercises are multiform, and can be extended to an indefinite number. Everybody can choose from a book on Gymnastics those he prefers. In the meantime I shall here point out those which I have myself adopted.

First Exercise. Movements of the Neck.—I have first of all directed my attention to the movements of the neck, which have a direct influence upon the head and all the noble organs placed in it. The various movements are the following:

1. Movement of the head to the left, turning the face as much as possible in that direction; then movement of the head to the right.

This double movement I generally repeat ten times. Having on one occasion a very bad headache, I derived much benefit from moving my head thus from right to left at least fifty times.

2. The second movement is to bend the head backward and then forward. This also I repeat ten times. Be it understood that the head must first of all be bent backward as far as possible, and then in a similar manner it must be bent forward, and so on.

3. The third movement consists in a rotatory motion of the head from left to right in front, leaning it over the chest and right shoulder, then bending it backwards and bringing it from the right shoulder to the left across the back; then leaning it over the left shoulder, and so on, continuing the rotatory movement without violence but rather swiftly for ten times. After a short pause, the movement should be reversed from right to left in front, and from left to right across the back. This should also be done ten times.

Some teachers have thought—and not without reason perhaps—that this movement would be more properly expressed by the word *circumduction* than by the words *rotatory motion*. What I

wish is that every one should have a clear idea of what I mean, but all are welcome to use the words and phrases they prefer.

4. The last movement with the neck, or, as I have said before, with the head, is the leaning of the head first on one side then on the other.

At first these movements will not only appear difficult to some, but they will also cause a momentary giddiness. But no one need be alarmed at this. After the first fortnight the head becomes sufficiently disciplined to triumph over the drawback, and by degrees we understand and appreciate the advantages derived from these exercises. I may here remark that habit has enabled me to go through the rotatory movement as often as fifty times very quickly without experiencing the slightest inconvenience, even when in executing it I happen to keep my eyes open.

After these preliminary exercises I am in the habit of going through other very brief ones, which cannot properly be called elementary, adapted to two iron brackets (wooden ones will answer the purpose so long as they are strong and safe), which are solidly fixed in the wall, about seven feet from the ground and about sixteen inches apart.

First of all I hold on to one of these with my right hand, and from it suspend the whole weight of my body, and then I do the same with my left hand, but each time for only a few seconds. Then holding on by both hands I pull myself up so as to touch the brackets with both shoulders. Letting myself slowly down I resume the pulling up, and repeat it about twelve times. He who has never tried to pull up the whole weight of his body in this manner will probably not at first succeed in doing it, but by forcing himself to it day after day, and by helping himself with the toe of one foot against the wall, the neophyte will gradually be enabled to go through this exercise and repeat it several times. No one can fail to perceive the importance of this feat, as it offers the simplest mode of acquiring strength in the forearms, in the biceps, in the muscles of the shoulders and chest, and of invigorating at the same time those of the hands, fingers, and wrists.

SECOND EXERCISE. MOVEMENTS WITH THE ARMS.—We come now to the elementary exercises of the arms. Whoever opens a book on gymnastics will find that these can be multiplied *ad infinitum*, and that in order to render them more efficacious it is generally recommended to execute them holding a dumb-bell in each hand. For my part, however, I have restricted these movements to a small number which I practice without dumb-bells. They are as follows:

Triple movement of the arms above the head, sideways, and

straight in front.—Bending both arms and placing the hands (closed) high on the chest, I jerk the hands and arms upwards so that they reach a perfectly vertical position, and then bring them back swiftly to their position on the chest; next, I execute the second movement, which consists in the simultaneous extension of both arms sideways—that is, the right arm towards the right, and the left arm towards the left—in such a manner that they are horizontal and in a line with the back and with each other; and lastly, replacing my hands—still closed—on my chest, I throw them out in front in a horizontal position and parallel to each other.

These three combined movements, which I have thus reduced to a single exercise, I repeat not less than ten times.

2. *Backward movement of the arms.*—With closed hands again on the breast as starting-point, I twist both fists downwards and give the arms a strong jerk backwards, keeping them parallel to one another, and endeavouring as far as possible to bring them into a horizontal position behind my shoulders. This movement I also execute ten times.

3. *Rotatory movement of both arms forward and backward.*—This movement is not easy for beginners, and it is therefore advisable to train each arm to it separately. It consists in throwing forward both arms well stretched, then raising them over the head—or rather, shoulders—continuing the movement backward and downward, and lastly bringing the arms again to the front, thus making them describe as large a circle as possible. They should be well stretched out all the time, and should be parallel when in front and over the shoulders. This exercise should be repeated ten times, rapidly and with energy.

Then a similar movement is made with both arms in the opposite direction. They are thrown out in front well stretched and parallel, and are then moved downwards, backwards, and upwards, so as to describe as large a circle as possible. This should also be done ten times.

In these movements the hands may be kept open or closed. I prefer keeping them open, and turn or twist them from right to left and from left to right in order to exercise the muscles of the wrist.

THIRD EXERCISE. MOVEMENT OF THE TRUNK.—These exercises ought indeed to be called by their right name—movements of the spine—because it is the spine which is particularly benefited by them.

1. *Bending the bust forward and backward.*—Bend the bust forward and downward so that the tip of the fingers may reach down as near as possible to the toes, holding the arms well stretched and parallel to the legs; then raise the bust, and

holding up the arms, bend backwards, the head following the same movement, and the arms in the most convenient position, either stretched out backwards, or hanging loosely by the side. The knees must not be bent—at least, not when the bust is curved forward. When these movements have been repeated three or four times with energy, it will be found that the muscles have acquired sufficient elasticity to allow the hands to reach the feet. I, for instance, from long habit, can now touch the ground with the palms of my hands without in the least bending my knees, but holding the feet about ten inches apart, for with the feet close together the said movement is almost impossible.

I recommend that in bending the bust backwards, the spine should be curved as much as possible; and you will easily see why I insist upon this, when you consider that in the common habits of life we have frequent occasion to stoop forward, while it is but of rare occurrence that we find ourselves obliged to bend our body backward.

2. *Bending of the bust down sideways, first to the right and then to the left.*—In bending the bust sideways to the right, you must endeavour to reach with the right hand as far down the right leg as possible without bending the knee. The head should lean over as much as possible on the right shoulder, and the left arm should be arched over the head. A similar movement should next be executed with the bust to the left side, the left hand reaching as far down the left leg as possible, the head leaning on the left shoulder, and the right arm arched over the head.

3. *Turning or twisting the bust to the right and left.*—With both hands on the hips and the elbows turned backwards, so as to expand the chest as much as possible, turn the bust vigorously to the right, and then returning to the normal position turn it with equal vigour to the left. The head must remain motionless, looking straight forward. This double movement, like the others, to be repeated ten times.

4. *Rotatory movement of the bust.*—This movement consists in bending the bust forward, then bringing it to stoop over the left side, then continuing the movement backward, so as to bend the bust as far back as possible, then still continuing the same impulse, bend it over the right side, and from this position bring it into the first position of stooping forward, thus completing the rotatory movement. It is well to continue this movement three or four times and then reverse it, bending the bust over the right side, then backwards, then bending it over the left hip, and finally bringing it into its first position in front. The head should follow all the phases of these movements, and the hands should be joined behind the back.

These four, or rather eight, different movements of the bust have, as I have before said, a direct action on the spine, or to express it better, on the cartilages connecting the vertebræ, and tend to keep their activity and increase their elastic qualities, thereby rendering every movement of the body easier and more elegant, and maintaining in full health the vertebral column in which so much of our physical life is centred.

FOURTH EXERCISE. MOVEMENTS OF THE LEGS.—*1st Movement*:—Raise the right knee as high as the shoulder, keeping the tibia perpendicular to the ground; bring back the leg to its normal position and execute a similar movement with the left leg. It will seem, and really is, difficult to touch the shoulder; or rather the upper part of the deltoid with the knee, but by practising the movement day after day the muscles gradually stretch, and we find at length that we are enabled to do it without any great effort.

This movement, as well as the others I shall here indicate, should be repeated at least ten times.

2nd Movement.—Raise the right knee again to the shoulder, throw out the leg horizontally and well stretched, then bend the leg downward and jerk it backwarks vigorously (as if giving a kick) and endeavour to raise it as near as possible to a horizontal position behind the back. Then, bringing it back to its normal position, strike out with it to the right, also endeavouring to bring it into a horizontal position, then letting it resume its normal position, you execute the same movements with the left leg.

In these 1st and 2nd movements, care must be taken to keep the foot bent so as to be as nearly as possible in a straight line with the leg, because if the foot be kept at right angles with the leg when in action, the movements appear clumsy and devoid of grace, or to be more explicit, vulgar.

3rd Movement.—Bend both knees and let yourself down until the haunches come in contact with your heels, and then raise yourself up again. In executing this movement you must first of all raise yourself on tiptoe and separate the knees more and more as you go down. This movement is one of the best adapted for strengthening the muscles of the legs and thighs, and may well be repeated more than ten times.

4th Movement.—Place your feet apart, say about 30 inches, and bend the right leg so as to allow the haunch to come in contact with the heel, and at the same time stretch out the left leg as far as possible, keeping the sole of the foot on the ground. Then spring up quickly and vigorously, and make a similar movement by sinking on the left leg, stretching out the right foot, and again springing up. Continue these alternate movements ten times with each leg.

In these movements, as in the preceding one, care must be taken to raise the heel off the ground and remain on tip-toe, with the foot of the leg that is bent down, in order to render the exercise easier and more graceful. This movement is rather difficult to accomplish at first, but with a little patience and perseverance you will find that continued practice will soon render it very easy, because all the muscles employed will obtain by degrees the necessary strength and energy. This movement is even superior to the preceding for giving strength and power to the legs.

FIFTH EXERCISE. RUNNING.—It is not unnecessary to say a few words about this exercise, which, although accomplished simply with the legs, has nevertheless a direct influence on the entire organism. It is an excellent discipline for the heart and respiratory organs, and is the best for attaining that force of resistance which constitutes true vigour and robustness.

Anyone who takes these notes of mine into consideration, and who feels disposed to practise the exercises I am describing, must shorten or lengthen this particular one according to his own constitution; still I advise him not to allow himself to be influenced on the one hand by laziness, or on the other by impatience, which may easily result from a too-prolonged exercise. And I say this because all the foregoing exercises, being of short duration, and this one forming an exception, it naturally disturbs the acquired habit of passing rapidly from one to the other, and consequently from its being out of the common routine, is liable to prove irksome and tedious. In this instance, also, through patience and good-will we may get accustomed to count without a grudge the long minutes that a little healthy running occupies. I have reconciled myself without regret to the ten or fifteen minutes which I every morning dedicate to this hygienic discipline; and, indeed, I believe that anyone may, through a little effort of the will, force himself into following my (not bad) example, as he will be able to comfort himself with the idea of thereby obtaining a no slight advantage in the energy and health of the whole frame.

SIXTH EXERCISE. MOVEMENTS WITH CLUBS.—Persian clubs afford the means of making some of the healthiest exercises, having a direct action on the most vital parts of our physical structure, on the jewel-box—the chest, and all it contains. The Persians, though inhabiting a warm climate, owe their strength and vigour to this simple exercise.

In England, France, and Germany, several works have been published respecting this gymnastic apparatus. Some prefer a single club, and with it exercise one of the arms at a time; others have decided in favour of the simultaneous use of two

clubs of equal size. I have chosen the latter method, and of the infinite number of exercises have selected and practise only a few of the simplest. My clubs measure about 30 inches in length, and do not weigh more than 17 pounds. In shape they resemble an elongated bottle. They are made of ilex wood and are loaded with lead at the bottom so as to give them the requisite weight.

1*st Movement. Raising both clubs to a horizontal position.*—Place the clubs upright before you on the ground, grasp the handle of each with the corresponding hand in the same way as you would the hilt of a sword, raise them up horizontally in front of you, holding them close together; then separate the arms until they as well as the clubs are on the same line with the shoulders—the right arm stretched out to the right and the left arm to the left (thus forming the figure of a cross); then lower the clubs gradually and place them upright on the ground, one near each foot.

This movement is rather difficult, and cannot be mastered without much preparatory exercise, and I should therefore advise any one who wishes to succeed in it to begin by practising the movement with lighter clubs, and to gradually increase their weight; and this suggestion holds good for all the club exercises which follow.

2nd Movement. Rotatory movement of both clubs round the head, beginning in front.—Take hold of the clubs as above, one with each hand, raise the right arm over the head holding the club as nearly perpendicular as possible, swing it round behind the left and right shoulders back again in front, and continue the rotatory movement. Meanwhile a similar movement is being executed by the left arm, which swings the club over the head and behind the right and left shoulders. The movements are timed so that the clubs pass over the head alternately. This feat is very easy, but care must be taken to begin with the left arm when the right is already in motion, and at the precise moment when the right hand club is rounding the middle of the back. This simultaneous movement of the two arms and clubs can be repeated ten times or more as one may feel disposed.

3rd Movement. Rotatory movement af both clubs round the head, beginning from behind the back.—This movement is similar to the preceding, with this difference, that instead of swinging the clubs round the head alternately with the right and left arm in front, the right arm must be raised, first making the club pass backwards round the right shoulder over to the left across the back, bringing it round in front to its first position by the side of the right leg, the rotatory movement being

continued over the head. The club must be kept in a perpendicular position as far as possible.

It is prudent with heavy clubs not to have both arms in motion simultaneously, the movement being rather a strained one and apt at first to cause the clubs to strike against each other. I should therefore advise the movement to be executed eight or ten times with the right arm, and then twelve times with the left, it being always well to give the left arm a little more exercise in order gradually to make it as strong as the right.

4th Movement. Another rotatory movement of the arms.—Raise, or rather swing, the right arm and club straight in front, so that the arm and club form a straight line, raise both swiftly to the vertical position, continue the rotatory movement straight behind, downwards, past the right leg, and so on for five or six revolutions. The same must be done afterwards with the left arm and club seven or eight times, for the same reason as above given, namely, to give more power to the left arm.

It stands to reason that this movement cannot be executed by both arms at the same time, because in order to accomplish it properly with the right arm you must of necessity move the right shoulder forward and the left shoulder back, while in doing it with the left arm each shoulder must make the contrary movement. If, therefore, both arms act at the same time, the exercise can only be imperfectly performed, and with heavy clubs it would certainly be dangerous. Even without clubs it can only be imperfectly performed with both arms simultaneously, as neither arm can, if moving *pari passu* with the other, ever reach the vertical position over the shoulder. You will thus see that this rotatory movement must first be done by one arm five or six times, and then by the other.

5th Movement. Last Rotatory movement of the arms.—This exercise is similar to the preceding one, with this difference, that instead of swinging the arms and clubs forward you must swing them backward. First swing the right arm and club rapidly backward and round so as to pass perfectly perpendicular over the right shoulder, continuing the rotatory movement five or six times. The arm should be well stretched out, and should always be in a straight line with the club. Proceed similarly with the left arm and club.

6th and 7th Movements.—These are simply a repetition of the two elementary movements of the legs which, in this case, are rendered more difficult by the additional weight of both clubs, which are held suspended perpendicularly one in each hand, the arms being stretched out in front.

Twenty-five years ago, after carefully examining and testing for more than a year all the movements that can advantageously

be performed with the clubs, I determined to restrict them to those which I have endeavoured to explain. I do not, however, pretend that my choice is the best, and everybody will do well to choose for himself any other movements which may be more to his liking.

SEVENTH EXERCISE. RAISING WEIGHTS BY MEANS OF PULLEYS AND CORDS.—This arrangement of weights and cords is the invention of Professor Mengozzi, Director of the Gymnastic Society of Leghorn. By its means many different exercises can be performed, all of which have their peculiar effect on the muscles of the arms, chest, and shoulders, while at the same time they call into play the muscles of the legs, and have a healthy action on the spine. After having practised them all I decided on limiting myself to one for my daily programme for the dressing-room.

These weights rest on the floor, and are raised by means of small ropes which pass through pulleys suspended at the end of two iron brackets, firmly fixed in the wall, about five feet from the ground, and about twenty inches apart. These small ropes end in two wooden handles, one for each hand. The cords are about ten feet in length, so that when performing the exercises you stand about five feet from the wall.

The first movement is performed with the right arm. Place your right foot forward, and planting your left foot firmly on the ground, about three feet behind the right, lean against both handles held tight, one in each hand, the arms bent, the elbows by the side, the hands about the height of the shoulders, and in a line with the chest, and the rope passing outside the arm. Now thrust forward vigorously the right arm as far as possible, bending the body forward at the same time, and the weight is raised off the ground. The left arm, meanwhile, rests passively against the other handle and rope.

Raising the body slowly, and bending the arm equally slowly, the weight is gently lowered to the ground, and the arm, hand, and handle, resume their first and normal position. This movement can be repeated five or six times as one is disposed.

The second movement is made with the left arm. The left leg and foot are put forward, and the right foot is placed about three feet behind the left. Then the left arm and hand are thrust forward in the manner indicated above.

I have always been in the habit of performing this movement three or four times more with the left arm than with the right. In the usual habits of life the right arm and leg are called into action much more frequently than the left, and it is well to give the left side a chance of obtaining a more equal share of strength and development.

I began this exercise with only 45lbs. for each of the weights, but I gradually increased them until I stopped at 90lbs., and it seems to me that I can now raise this weight with the same ease as I at first raised the half of it. I believe that, if we wished to do so, we might train the arm so as to lift much heavier weights still, but I should not deem it prudent for anyone to go beyond the above limit which I have drawn for myself.

There only remains for me now to indicate the series of movements which I have found it useful to practice in bed, lying in a supine position. I hope I shall succeed in describing them so that the reader may easily understand them, although the task appears to me rather a difficult one.

These movements are fitted to call into healthy action almost all the muscles of the body, beginning with those of the feet, legs, thighs and hips, and ending with those of the abdomen, chest, and arms, shoulders and neck.

FIRST EXERCISE.—At night after having performed all the customary ablutions and after having "groomed" myself with hard brushes from head to foot, so that I at last enjoy the most agreeable luxury of stretching myself out all clean in bed, lying down in a position similar to that of the Egyptian mummies, I begin with the hygienic exercises of the legs. This consists in first elongating as far as possible the left leg and shortening the right, as far as the limited play of the hip will allow of; and then *vice versâ*, elongating the right leg and shortening the left one.

These alternate movements must be done with rapidity, allowing at the same time the muscular masses of the abdomen to participate in the movement.

I have got into the habit of making 300 such movements with each leg, and I can aver that it is with some difficulty that I check myself from going through a greater number, but as we must draw a reasonable line in all such exercises, I have not thought it advantageous to do more.

SECOND EXERCISE. *1st Movement with the feet.*—Stretching both feet downwards so that they are in a line with the legs, separate them at the toes and touch the bed on each side with the little toe of each foot, thus bringing the feet into a position at right angles with the legs and in a line with each other; then raise the toes from the bed and bring the feet together, endeavouring to make as small an angle as possible between each foot and its shin-bone; lastly, stretch them out again downwards, and repeat this rotatory movement five, ten, twenty, or even thirty times.

2nd Movement.—This consists in executing a rotatory movement in the opposite direction to the above-mentioned, namely,

placing the feet side by side in a perpendicular position, then separating them as before, right and left, so as to touch the bed with each of the little toes, joining them again well stretched out downwards and in a line with the legs, and then raising them again to their first position perpendicular to the bed. This movement should be repeated as often as the preceding.

These movements tend to promote elasticity in muscles that otherwise are rarely brought into action.

THIRD EXERCISE.—This exercise calls into action all the muscles of the feet and legs.

Placing the feet side by side in a vertical position, with the legs joined and well stretched out, render all the muscles of the thighs, calves of the legs, and feet as rigid as possible for a second or two, and then relax them. Continue this alternate action as many times as you feel disposed. I am in the habit of doing it a hundred times without feeling at all tired.

FOURTH EXERCISE.—Movement of the legs imitating the action of swimming on the back. This is very hygienic and can be repeated as often as one likes—say twenty or thirty times.

FIFTH EXERCISE. *1st Movement of the arms.*—Extending the arms along the sides, with the hands well shut by the side of the hips, press the fists on the bed, the knuckles downwards, and endeavour to raise the bust, slightly arching the back inwards; then returning to the normal position, turn the fists, knuckles upwards, and repeat the movement of raising and arching the bust. These alternate movements should be continued at least twenty times. I habitually repeat them fifty times without feeling at all inconvenienced.

SIXTH EXERCISE. *2nd Movement of the arms.*—Continuing to keep the arms perfectly straight, but opening the hands and placing them alongside the hips, raise the right shoulder towards the right ear, and at the same time lower the left shoulder as far as possible; then lower the right shoulder and raise the left. Continue these two movements as rapidly as possible a good many times. I myself repeat them a hundred times.

This exercise is of considerable benefit to the muscles of the chest and shoulders, and is fitted also to give tone to the liver and bowels from the slight movement which is given to them.

SEVENTH EXERCISE. *Movements of the neck. 1st Movement.*—Turn the head towards the left shoulder so that the left ear touches the pillow, then moving or rolling the head against the pillow slantingly downwards raise it to the supine position. Then execute a corresponding movement towards the right, turning the head so that the right ear touches the pillow; complete the rolling movement as before, and raise the head to the

supine position. Repeat these movements as often as you feel disposed. I generally do it thirty times on each side, but for a beginner five times is perhaps enough.

2nd Movement of the neck.—Bend the head forward as much as you can, then raise it up again and bend it backwards and downwards on the pillow, as far as possible. This movement may also be repeated five times by beginners.

3rd Movement of the neck.—This movement consists in holding the head supine, and bending it as far as possible first towards the left shoulder and then towards the right. This double movement may also be repeated at least five times.

The above movements tend to impart strength and elasticity to the muscles of the neck, and also to the upper part of the vertebral column, and they have moreover a healthy influence on the membranes and muscles of the brain, because everything that tends to slightly agitate all parts condemned to inertness produces a tonic effect which increases vitality and brings health and prosperity to the part acted upon.

EIGHTH AND LAST EXERCISE. *Movement of the Abdomen.* This movement is performed in the following manner: maintaining the shoulders in their position, and lying supine, endeavour to turn the abdomen as much as possible towards the left side slightly raising the left hip; then returning to the normal position, go through the same movement towards the right, slightly raising the left hip. These movements must be effected with much energy, and can easily be repeated twenty times with much benefit to the peritoneum and all the viscera.

When all these exercises have been gone through the whole frame experiences a feeling of contentment and comfort, which proves their opportuneness and efficacy.* To cite my own experience, I may say that when I have thus gone through the whole of my small programme, it really seems to be as if every part of my organism rejoiced and said, "Thank you! thank you!"

This kind of exercise I have not found in any work on gymnastics, and I am confident that some medical men, prompted by a genuine feeling of philanthropy, will find in them something useful for their patients, in order to render their convalescence shorter, even if they do not suggest them for their tonic effect to people in perfect health. At all events I very much desire that persons more expert than myself in these matters should test them and draw up for the benefit of

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* I also go through all these movements, but for a smaller number of times, when I return to bed in the morning, after my cold bath, in order to obtain a more rapid and more thorough reaction.

mankind a scientific treatise respecting them, with all the modifications they may deem it proper to introduce.

Let me now recapitulate in figures what I do on an average in the course of a year, for the purpose of keeping up the symmetry of my bodily frame and endowing it with robustness and health. It is a sort of statistics which may have some interest for those who direct their attention to Calisthenics and Hygiene.

The following is the list:—

200 miles running.
4,000 leaps (standing leaps).
150,000 movements of the legs.
50,000 „ „ arms.
100,000 „ „ neck.
40,000 „ „ bust or vertebral column.
4,000 times I have pulled up my body with my arms: that is, I have raised in all 800,000 lbs. a height of about two feet.
300,000 lbs. I have raised with Mengozzi's apparatus a height of three feet from the ground.
200,000 movements I have made with the clubs, which answers to raising 300,000 lbs. a height of three feet.

But these figures are not given as a standard, and I say this so that no one may feel alarmed. Even in doing one-fifth of the exercises I have here enumerated, many persons would find that they are going beyond what is actually necessary to promote and maintain in their body the robustness, elasticity, grace, symmetry and health requisite for the full enjoyment of existence. But on the other hand to abstain entirely from all hygienic exercises, as is too frequently and, I may say, generally the case, and actually do nothing for the culture of our body is, I repeat, a great blunder in our present civilization—a defect and a void which must be corrected and filled up during our present progress on the higher plane of thought and knowledge.

It will be easily understood that all these movements, each of which is specially intended to benefit some particular muscle or group of muscles, must necessarily exercise a useful influence on the entire organism. This has been the case with me, as any one skilled in physiology could at once verify by closely examining the healthy and vigorous state of my whole body.

The unprejudiced reader will doubtless comprehend that the time thus expended in cultivating the body, brings advantages that no one can despise or make light of, when he considers what the happiness of our present existence depends upon, and how valuable are all those means which ennoble our coporeal frame and promote its wellbeing. In conclusion: *nothing for*

nothing in this world; and whoever has at heart the happiness of his own being will not hesitate, I believe, to devote daily a small portion of his time to consolidate his health and render more perfect his material frame.

And here this brief treatise on *hygienico-gymnastic exercises in the bedroom* might close. I am, however, desirous of adding a few remarks.

Italy is a land known to the world for the high intellectual powers of her inhabitants, and this is not the mere fancy of those who pride themselves on having been born under her brilliant sky, but a fact which history proves to every thinking mind. Relying with much inward satisfaction on this fact, I feel encouraged to hope that this modest paper will be understood and appreciated by my countrymen, and that a goodly number of them will follow out, if not in its entirety, at least in a certain measure, what I have submitted for consideration.

I hold, indeed, that if my words met with benevolent attention throughout the whole of our Peninsula, this country would, in the space of a few years, rank as the first in the world, because it would be peopled with men who, besides possessing superior intelligence and genius, would also possess more health, more robustness, and more energy than any other branch of the human family.

But I well know that this is not to be hoped for. The world follows promptly every whim of the goddess—Fashion; but to change habits in order to comply with the injunctions of the best and most practical reform which concerns the health and happiness of humanity requires time, as it invariably meets with a host of opponents. This seems, indeed, to be a law of nature, in order perhaps that man should not too quickly reach the goal of his destinies in this sublunary sphere.

If we consider why Fashion has such irresistible force, we find that the secret motive which all men for the most part obey is not Utility, but Vanity. In the present case I feel I can also invoke the aid of this irresistible power, inasmuch as these hygenico-gymnastic exercises have assuredly the effect of ennobling and embellishing the human frame.

And here I cannot help expressing a heartfelt wish which I hope will not be allowed to pass unobserved. This wish concerns the gentler sex—our companions in this existence, to whom Nature has confided the sacred duty of perpetuating our species. My earnest desire is—that a skilful female teacher of the gymnastic discipline should conceive the happy idea of writing an essay which should be serviceable, not only to young women, but to women of maturer age, in showing them how to improve and invigorate their frame, so that their offspring

may thereby be benefited. If such a work, coupled with a name of some authority, could see the light of day in Italy, it would cause a great awakening. It would exercise a most favourable influence on the gentler sex throughout our Peninsula. I should rely on *their* good sense for giving such a book the consideration it would deserve, and am confident they would make it a duty to follow out its precepts, certain as they would be to derive from them immediate advantages superior to all else that captivates their vanity in the fashions that come to them from beyond the Alps. No dress, however splendid and becoming, will ever add more to their charms than would the properly practised rules of well-chosen gymnastic exercises, these alone having the power of ensuring to them the florid, elegant, æsthetic and winning appearance, which ever accompany prosperous health, robustness and elasticity of the whole frame (See page 181).

If, instead of wearing garments of silk and satin, which often serve as the white-washed walls of sepulchres, to cover what is hideous with a false appearance of brightness and beauty, everyone were obliged to show himself or herself to the public gaze with the only covering nature has provided us with—the *bare skin*, I feel pursuaded that the magnificent carriages which every day convey persons, more or less conspicuous, to the Bois de Boulogne or Hyde Park, would be filled with people who, with the greatest scruple and the most untiring patience, would daily practise all that I have here pointed out, as no one would then wish to submit to the humiliation of showing himself or herself inferior to others in point of physical education and refinement.

But such is not the case, nor is it likely it ever will be. In this connection I beg to be allowed to mention a trifling circumstance which struck me very much when I was a child. An English gentleman wishing to change his coat for a lighter one on account of a variation in the weather, asked his servant, in my hearing, if he had cleaned it properly, to which the latter replied that he had brushed it well. "But," inquired the Englishman, "have you turned the sleeves inside out so as to brush off the dust inside? If you have not, do so at once, for I prefer having my clothes cleaner inside than out."

This idea of scrupulous cleanliness (rather exaggerated in this case, however), pleased me as a principle, and I have not only kept it in my memory but I have also acted upon it. And why, I ask, should we not endeavour that all that remains hidden from view should be kept in a state of perfect cleanliness and æsthetic beauty?

Answers to this query would be rather amusing, I doubt not,

if we could only obtain them genuine. The majority would limit their response to something like the following:—"You are, indeed, a curious fellow. It is not likely, indeed, that I should go out of my way, and take so much trouble about all that remains unobserved, and that nobody has any curiosity to inspect! If my dress is decent outside that is all that is needed, as I have, thereby, paid my tribute to respectability." But other individuals, misshapen by fat, with stooping shoulders, and with a face bearing the expression of sloth and effeminacy, would blurt out—"Just imagine if we are likely to place our dignity in jeopardy by running, jumping, and turning and twisting, about in such an odd fashion! Go among the Zulus: they are the people to appreciate your advice!"

There are those, however, who, versed in pathological science, might bring some rational objection, likely indeed to convince the many. They might say, for instance, that after a certain period of life any pretensions as regards strength and agility are injurious to the health, and that the majority of those who should allow themselves to be won over through my words would pay rather dearly for their imprudence—and justly so—and dig their graves before the time.

The very example of the Argyrasps already referred to stands out as a proof that this assertion is a lame one. The Argyrasps were men of between 60 and 80 years of age, who in military discipline and military exercises, in sustaining the fatigues, discomforts, and hardships inseparable from long marches, and in hardihood and firmness on the battle-field, proved themselves superior to the men belonging to the younger phalanxes.

In the "Lives" of Plutarch we also find examples of illustrious men who having passed their 50th year were as strong and active as any young warrior.

In our own day it is not uncommon to remark the vigorous and enviable state of health of those who, at an advanced age, have continued to devote themselves to hunting and sport; and this offers an undeniable proof that exercise, even when violent, is productive not only of no harm but indeed of much good to those on whom the winter season of life shows white upon the head.

To such opponents I may, on the other hand, observe that, as I have already said, my programme is not to be followed out fully and at once but by degrees. I will also add that they who, having accepted my advice, should succeed in going through all the exercises I have above indicated and should wish to continue them as an excellent method of preventing all kinds of illness, must nevertheless not always repeat them *in toto*, unless they experience a positive craving in the muscular

system to go through the whole programme. It is useful and wise to change at times the above exercises; that is to practice more especially some for a time and neglect others, and then take up the latter and neglect the former; or proceed as is done in the "arsenic cure"; that is begin with very little, gradually extend the programme until it includes all the exercises, and again descend by degrees to the elementary movements. In this way every one will have it in his power to derive benefit from this discipline, and medical men, who generally know next to nothing about the therapeutics of the gymnastic art, will be greatly astonished to witness the metamorphosis which will have taken place in the organism of the neo-gymnast, no longer their patient.

I could mention many facts, but the history of my own case is sufficient.

I venture again to assert that, unfortunately, few medical practitioners have from their own experience any knowledge of the tonic and healing effects of educational gymnastics; and it would be for the good of humanity if the medical student, in order to obtain the degree of doctor, were obliged to be fully cognizant of the value of physical education, and submit to a severe examination in all the different branches of its teachings

Most illnesses have their root in the inertness in which our organism is, in accordance with modern habits, for the most part condemned to languish. Inertia impedes and corrupts the regular functions of our bodily mechanism, especially if coupled, as it generally is with over-abundant nourishment. Our modern followers of Æsculapius could therefore do nothing better than, having first through their own experience, convinced themselves of this truth, prevent sickness by inculcating the principles and practice of physical culture, which constitutes an invaluable panacea.* But—and it can easily be surmised that the "but" I am about to give utterance to is indeed a terrible one—but of what use would the healing art become if everybody knew, appreciated, and applied this easy, and I may say recreative mode of preventing illness of almost every kind? I leave it to you to meditate over this query, and to tell me if this state of things be not an anomaly in our present civilisation.

* I feel obliged to apologise for these words of mine to many excellent physicians who have of late years afforded brilliant proofs of how they appreciate the great advantages to be derived from physical education, that is, from gymnastic exercises, by people both in good and ill health, and particularly by children affected with *rachitis* (rickets); and I cannot help mentioning, as worthy of public esteem and gratitude, Professor Alberto Gamba, of Turin, who deserves well of his country for the humanitarian feeling which prompted him to initiate the cure by gymnastics of children affected with rickets, and who has earned imperishable fame by the splendid results he has thereby obtained.

The medical art has indeed no interest in preventing diseases, nay, every effort made in this direction is necessarily hostile, not to say fatal to its object and ministrations.*

It were vain for me to prolong my discourse on this point, and I therefore leave it to every one to make the use he likes of my words. Certain it is that since the beginning of this century great strides have been made respecting the culture of the body, and that even in this country (Italy) this idea has also gradually developed, so that we may be justified in hoping that we are nearing a time in which we shall be on an equal footing in this respect, not only with Germany but also with England herself.

Our present Minister of Public Instruction, a man well known for his eminence in science, will, we trust, give a fresh impulse to the ideas and principles of which Francesco de Sanctis was the promoter, if he determines on calling to Rome some of the more authoratitive devotees to gymnastic discipline, in order to consult them. And I say this because men who have thoroughly studied Physiology—one of whom is our Minister, Baccelli— are too apt to think that the light of such Science is sufficient to enable them to know all that is required in order to educate our organism in such a manner as to endow it with the necessary vigour and robust health; whereas Physical Education is too complex a matter to allow of the rules by which it must be guided to be easily established, without consulting those who have grown grey in making it their special study. I, for my part, who have always been particularly devoted to this branch of education, should wish that the Minister for Public Instruction would appoint a Commission of three persons to visit Switzerland, Germany, Belgium, Holland, Denmark, Sweden, France, England, and the United States of America, inspect every college, lyceum and university, and also all the most noted gymnasiums, and on their return home draw up a report of all that Educational Science has tried and found expedient in these parts of the world, in order to bring, as far as possible, to perfection the human frame of both sexes.

In this manner our Minister would easily be able to judge what had best be done in order that our ancient race should, through this bodily discipline, obtain the elements requisite for being, even in our present period, second to no other on earth. He would, to my mind, be accomplishing an act of the greatest

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* A medical man, my intimate acquaintance, to whom I expressed these ideas, accusing him of cynicism because he was loth to recommend hygienic gymnastics, for fear it would "frighten away birds from his trap," answered me thus: "Well, after all, we can even allow the practice of gymnastics, for when we consider that a single dancing-party is enough to afford us food for a whole year we ought to be well satisfied."

patriotism, which would speedily realize the wish expressed by Massino d'Azelio: "*Now that Italy is made, we must make the Italians to suit it.*"

Some five or six years ago Disraeli, in one of his speeches in the British Parliament, said, "that, after all, the first people in the world would be the one possessed of the greatest amount of health." Physical Education, well understood and well applied, is alone fitted to realize this idea and endow a nation with this pre-eminence; especially if, together with its teachings, we enforce also—and sooner or later we must come to this—the study of Hygiene and Physiology.

I cannot, however, help repeating here what I have maintained on other occasions, namely, that methodical gymnastics cannot solely and alone educate the youthful frame in a way best suited for all the requirements of practical life; there are other exercises which are equally needful in order to promote robustness and energy, and they, too, must be taken into account and practised alternately with gymnastics. I mean such recreative games as are largely practised in England in all the schools throughout the kingdom—games which have the effect of rendering boys daring, fearless, hardy, and self-reliant. This is the great secret of British Education, and it would be well that Italy should adopt it, without, however, neglecting the teachings of gymnastics, which tend to the more symmetrical development of every part of the body. These violent struggles (such games *are* violent struggles), besides engendering, I say, strength and valour in the body, also tend to form the character endowing youth with moral energy and self-reliance. By their means boys learn to prefer all that is manly, courageous, and noble, to what is artificial, small-minded, and vile.

We live in a period of transition. The ideas of the past are fast disappearing with the dismal night whereon the words, "Ignorance, Privilege, Slavery," are still legible, and a new era is being inaugurated, inscribed with the brilliant legend, "Light, Brotherhood, Freedom."

To quote Gabriele Rosetti's beautiful lines:—

"Sei pur bella con gli astri nel crine
Che rifulgon quai vivi Zaffiri;
É pur dolce quell' aura che spiri,
Porporina foriera del dì!"

Which we may translate thus:—

How beauteous, crowned with stars that shine
All vivid like the sapphire's ray—
How soft and pure the air of thine,
Thou roseate herald of the day!

Our modest voice in favour of Physical Education is in full harmony with this splendid herald of the coming day. Whereas in the past, ignorance and tyrany wished to keep men poor both in body and mind; in the era we are now entering upon, man must prepare for the battle of life by equipping himself with vigour and perfection of frame as well as with nobleness of mind and heart. It is the *whole man* that is now demanded —man in full possession of all his attributes and faculties, for thus alone can he be in harmony with the new order of things.

It is a source of satisfaction for us Italians to know that we descend, with more or less of mixture, from a powerful race—a conquering race, perhaps the bravest and most gifted of all, and that it is but necessary to stir the still smouldering embers in order that our race may regain possession of its former virtue and worth.

My task is done.

APPENDIX.

The Physical Education of the gentler sex being also a primary question, I may be permitted to reproduce a portion of a paper on Gymnastics which I read before the Philological Society in Florence on the 12th of May, 1879.

And here in connection with the subject of Gymnastics for females, I feel bound to mention a female school which is unique in the world, namely, Vassar College, on the banks of the Hudson River, about 50 miles from New York. Vassar College was built by Matthew Vassar, who, having no children, devoted his riches to endowing his native country with this model school. He travelled much all over Europe, visiting the most renowned female institutions, and on his return home to America, bought a large piece of land on the Hudson, and founded this educational establishment for young ladies, where a complete moral and intellectual education is given hand in hand with an equally complete education of the body. Thus in the spacious park which surrounds the building there are a magnificent gymnasium, a riding school provided with excellent horses, various lawns for recreative games adapted for young ladies, and various artificial lakes for swimming, rowing, and skating. In this school there are now 500 pupils, and as soon as there is a vacancy it is immediately filled up, for the applications for admission are counted by the hundred.

Would that a second Duke of Galliera would endow Italy with a similar college for young ladies! Many suppose that physical education is not proper for the gentler sex. This is a sad mistake. Woman is intended by nature to become a mother, and if she be not in a vigorous state of health her offspring cannot but pay the penalty. It is the duty of all of us to devote our best care to rendering our body as healthy and perfect as we can, but that duty is undeniably paramount in woman.

Eugene Pay, the well-known and renowned French gymnasiarh, observes: "That we find in Genesis that God created woman from a piece of flesh taken from Adam; but that in our actual life the reverse is the case, inasmuch, as everyone knows, it is from the flesh of woman that the embryo develops and becomes a human creature: and it thence follows that it is woman's sacred duty to be brought up so as to be possessed of florid and robust health."

He then adds that women must practise gymnastics if they wish to be "healthy, well-developed, graceful, vigorous, and, especially *handsome*."

I repeat that I wish there were in Italy a Vassar College, as we need heneeforth that our women should be educated so as to fully discharge their mission.

SECTION II.

ENGINEERING AND ARCHITECTURE.

ADDRESS

BY PROFESSOR ROGER SMITH, F.R.I.B.A.,

PRESIDENT OF THE SECTION.

IN opening the proceedings of this section, I propose to address some remarks to you on a subject which I trust you will feel to be, at any rate, an appropriate one, and one suggesting many topics, namely—London dwellings. And I have selected such a subject in preference to attempting a general review of the wide field presented by the sanitary aspects of architecture and engineering, believing that the more limited task was one which I could better perform, and that perhaps for once, as a change, it might not be unacceptable to yourselves.

The capital of Great Britain is the most remarkable city of the world for wealth, influence, and extent. Its population equals that of a province, and is singularly well situated for scientific observation on account of its concentration, and of the comparatively uniform conditions under which it is placed. The sanitary state of London will always, for these reasons, attract marked attention. Nor is it devoid of personal interest to most, for there are very few even of those living elsewhere, who have no friend or relation among the vast crowds drawn to the capital by that strange attraction, resembling that of a loadstone, which it exerts over every part of the country.

Lastly, I may as well confess that the subject has suggested itself to me very much from the fact that it has been my lot to live and work as an architect in London for a good many years so that the dwellings of London people, rich and poor, have become familiar to me, and I may be able consequently to speak from personal experience.

Let us, to begin with, consider some of the conditions under which the inhabitants of London live and build their houses, taking first the physical ones of situation, climate, materials, &c., then the social conditions, then those imposed by law, and lastly the economic and financial conditions.

I.

London stands on a noble tidal river, sufficiently near the estuary for the tide to cause the Thames to rise and fall, and its current to turn backwards twice in the twenty-four hours. The principal tributary near London—the river Lea—falls in just east of the city, and drains the flat part of Essex. A small tributary stream of fine sweet water, the New River, has been entirely absorbed for the water supply of a part of London. Two or three others, as the Fleet and the Ravensbourne, are now sewers. The land north of the Thames is most of it gently undulating, sloping up to a range of tolerably high ground about four miles off, at Hampstead and Highgate.

South of the Thames and lining its banks, there is a great deal of very flat land, and east of the city, both north and south, level moist plains extend for a great distance. Westwards the country is hilly, and high land is also found south of the Thames at some distance.

The subsoil is a dense tenacious firm blue clay, known as the London clay. This is met with at various depths, but never far from the surface, under the whole of London. The surface soil is to a great extent a less compact clay, but in some localities it consists of gravel and sand, and near the southern bank of the river there are many spots where we meet with peat thinly covered with accumulated soil. This peat, I need hardly add, is permeated by the water from the river (which will be found to rise and fall with the tide in any deep excavation), while every where else the rain-water either remains on the surface where that is clay, or only penetrates through a thin pervious upper stratum till it reaches the London clay.

This circumstance combines with the large surface of water in the river and the docks to render the London climate a decidedly damp one, notwithstanding the moderate rainfall. A most noteworthy index of this dampness occurs in the famous November fogs, the worst of which produce a gloom deeper than anything since the Plague of Egypt.

The Thames is the only easily accessible source of water supply, and the only very ready channel for carrying away sewage. It is ill adapted for the former purpose, owing to the inhabited state of its upper reaches, and for the latter, owing

to the effect of the tides. Such improvements as have been made have, as yet, only resulted in mitigating the disadvantages by moving the intake of the various water companies higher and higher up the river, and the outlet of the Metropolitan drainage system lower down, but have not effected a radical reform in either direction.

The City of London was anciently founded on the north side of the river, and down to a time comparatively recent the south bank was not thickly inhabited. As soon as people began to extend beyond the city walls, the phenomenon so common in great cities showed itself, and the wealthy moved westwards, leaving the poor to extend eastwards. Various causes have led to a prodigious increase in the extent of London, and it is now difficult to assign limits to what is almost more a compact province than an extended city. Places that formerly were remote suburban villages have been now completely swallowed up, and many outlying districts that are situated outside the metropolitan boundary are really connected with the heart of London by unbroken lines of streets and houses. You may now go from Highgate on the north to Penge on the south, a distance of about ten miles, or from Stratford on the east to Hammersmith on the west, a distance of about twelve miles, without passing an unoccupied field.

The Commissioner of Police of the Metropolis, in his report for the year 1881 (the last published), states the area of London at 688 square miles, and adds that the population in that year was estimated at 4,788,657 persons, having risen to that enormous figure from 3,808,360 in the year 1871. No doubt at this time (near the close of 1883) it has reached the total of 5,000,000 persons.

It will be easily understood that even the refuse from so large a city constitutes a great difficulty. Much land is now occupied by houses which once was so far out of the way that it was used as a deposit for ashes, dust, and garbage.

London streets, even important ones, are, generally speaking, narrow, and the houses low. In some of the newer districts wide streets have been laid out, and the exigencies of traffic are constantly causing old thoroughfares to be widened and straightened at enormous expense. In many of the oldest parts of London, however, tortuous lanes, and narrow alleys, and blind streets abound, and the houses have little or no land in the shape of forecourt or backyard attached. London enjoys a compensation for her narrow thoroughfares in the number of fine open spaces. The parks have been well called the lungs of London; and, in addition to them, the many squares and the

wide channel of the Thames provide a sensible and welcome relief from the crowded and compact mass of dwelling-houses.

The materials available for building constitute, perhaps, the most important of the physical conditions of any city next to those created by the site on which it is built. No building stone is found within easy reach of London, consequently there are no stone-built dwelling-houses. It is true that here and there an expensively-built house is faced with stone, but even then the heart of the wall is of brick, and for our purposes London houses must be considered as all brick built. London bricks are made of brick earth, with which a portion of ashes or fine coal dust has been mixed. They are hand made and burnt in a clamp, not a kiln, and the effect of great heat upon the particles of coaly matter in the substance of the brick is to ignite them and promote the burning of the bricks equally throughout, leaving it then somewhat porous and light, but hard. The article so produced is called a stock brick; it is not handsome in shape or colour, but is in other respects good to build with if well burnt. Unfortunately a very large number of under-burnt bricks, which are soft and very absorbant of moisture, are produced and, as a rule, used. Sand and gravel are plentiful and mostly of good quality. Good lime is also easily obtained, and beyond this short list all the materials needed for building must be brought from a distance. London is, however, so well supplied with means of land and water carriage that there is little difficulty in obtaining any material in any quantity; and the great demand for timber, slates, and some sorts of stone has stimulated trade and created so much competition that the average prices of many of these are by no means high, and the supply rarely deficient, considering the distance from which they come.

Two excellent artificial building materials are products of the vicinity, and both exceptionably valuable. I allude to Portland cement, the manufacture of which is carried on largely on the banks of the Medway a few miles from London, and to glazed earthenware for drain tiles and similar purposes, which is largely manufactured in Lambeth.

II.

Turning, now, to what I have called the social conditions, the first, and by far the most conspicuous, is the constant pressure of increasing population. Families are growing up within, and are pouring in from without; for one who leaves London there are twenty who come, and a rapid, restless, resistless growth is the result.

This growth is clearly shewn by the increase of the population in the decennial period above referred to. This amounted, according to the figures already quoted, to an addition of 908,297 persons, or of more than 25 per cent. to the population as it stood in 1871. In these ten years from 1871 to 1881, no fewer than 162,525 houses were built, extending over 500 miles of squares and streets, and the rateable value of the Metropolis rose from £19,809,000 to £26,862,819. In the year 1881 alone 26,170 new houses were built, covering a length of 86 miles and 384 yards.

I have already spoken of the vast size of London, but its constant increase is at least as remarkable. It will be easy to understand that the enormous size and rapid growth of the metropolis, and the constant pressure under which its affairs, of every sort, are transacted, combine to render it most difficult to change anything, or carry out any measure that affects all London. When, for example, the main drainage of London was remodelled, about a quarter of a century ago, it was a colossal work. Improving the water supply of London has, as you all know, proved so much more formidable a business that it has, as yet, defied the efforts of the Legislature; and when, some years ago, measures were taken for obtaining a high-pressure service, it was calculated that, to carry this improvement out in every house in London, would throw upon the inhabitants an expenditure which was reckoned by one of the best authorities in millions of money.

The habits of those occupying this vast area are, of course, diverse in the extreme, but still they are, in some very marked particulars, definite, and have a bearing on house sanitation.

Perhaps the most strongly-marked London peculiarity is the desire to live, or seem to live, in a house of one's own. No Londoner, rich or poor, is at ease living at a boarding-house, at a hotel, or in a building obviously erected for many families. Vast numbers do live in lodgings, but then they prefer a house of such a stamp as might, by an amiable fiction, be supposed to be their own; and, as a consequence, the dwellings of the poor —and not only the poor, but of every class above them—are of moderate size, considering the people who occupy them. One result of this is, that there is very little demand, as yet, for high houses, and that vast spaces of land are occupied by houses of two storeys high.

Another peculiarity—in which, however, the Londoner only shares the national prejudice—is the universal use of open fireplaces. No house is heated by anything else, and hardly any room in any house is without its fireplace. The result is of great advantage to each individual, of serious detriment to the

community. Every room has a ventilating tube, of a rough construction, of about 100 inches sectional area, more or less, and this tends to secure a large amount of change of air; but the smoke from the fires which are lit in these countless fireplaces pollutes the air, and makes the London atmosphere unhealthy.

There is also a universal prejudice in favour of the sash window, sometimes playfully called the guillotine, as compared with the casement window, which is equally universal in France. The sash is decidedly more advantageous for a damp climate, and is a better ventilator, whenever it is desirable to open the window a little way.

Many, at any rate, among those who reside in the outskirts, are remarkably ready to migrate from one quarter to another, so much so, that not a few systematically change their dwelling every three years. The result of this is that much less care is taken in the selection of a house, much less money is expended in remedying defects, and many more serious evils are patiently put up with than would be the case were persons more in the habit of living long in one house; in fact, but for this custom a great many serious defects, sanitary and otherwise, would hardly, I think, have become quite so gross and serious as they actually are.

III.

The third element in determining the conditions under which the Metropolis is built is furnished by the Acts of Parliament that regulate buildings and streets and drains, and the official administration of these Acts.

There have been building Acts in London ever since the period of the Great Fire, mainly directed to diminishing the risk of another general conflagration. Of the Acts now in force, which are numerous, the most important are the Metropolis Local Management Act and the Metropolitan Building Act, with sundry amending Acts. The former of these contains, speaking broadly, the regulations as to drains and streets, the latter those affecting buildings. The central authority for drainage, &c., within the ancient and comparatively small limits of the City proper is the City Commissioners of Sewers, a branch of the Corporation. That for the rest of the Metropolis is the Metropolitan Board of Works—having affiliated to it a series of Local Boards, each consisting of a group of parishes or a single parish. Drainage is under the direction of surveyors, who are the salaried officers of the various Local Boards. The Building Act is administered by a large number of District Surveyors, who are architects in practice, and each entrusted with the supervision of the buildings in one locality.

The Building Act, besides attempting to secure a minimum of strength and solidity in walls, and requiring many precautions against the risk of fire, contains some sanitary regulations of considerable importance and value, though the Management Act is the one mainly directed to sanitation.

In what may be well called the outer zone, outside the Metropolitan area, vast districts have been and are being built over. These localities, so far as they are supervised at all, come under the action of the Public Health Act. Attention is usually paid to their drains, though but very little supervision has, as yet, been extended to the dwelling houses, no bye-laws affecting houses having till lately been passed in some districts. Moreover, where such rules exist, a supervision as thorough as that exercised within the Metropolitan area by District Surveyors, is not provided.

My own impression is that in the parts of London within the Metropolitan area legislation goes as far, or nearly as far, as it can be usefully carried. But there are many points in which Acts of Parliament, however good, and however well enforced, fail, and must fail to secure the public against the effects of their own apathy in everything that relates to the healthiness of their houses, combined with those due to the ignorance and cupidity of builders, who have no desire to do their work well, and little acquaintance with their business.

Legislation, allow me to point out, can only require a certain *minimum* of excellence, and that which is just good enough to evade the penalties due to a breach of an Act of Parliament may yet be very far indeed from what it ought to be; or would be if the public were at all critical as to the sanitary condition and general soundness of their dwellings.

If, however, it is possible to-day to report upon the material and legal conditions under which building is going on, as in the main fairly good, it must not be forgotten that they have not always been so. There was a time when the only sewers were for storm-water, and it was illegal to take drainage from houses into them, and as a result in the older parts of London we constantly come upon cesspools in the most objectionable positions, filled with old decaying matter, and sometimes not altogether disconnected from existing house-drains. There was a time when the window-tax caused openings to be both small and few, and led to dark rooms; and when many of the underground cellars, which it is now illegal to build for occupation as living rooms, except with good provisions as to air space, were tolerated, and when, owing to famine prices, and high duties and legislative enactments, the height of storeys was reduced to a minimum, the materials were saved in very possible way, and

houses which can never be thoroughly healthy or sound were built in large numbers.

IV.

What I have called the economical or financial conditions under which London has been and is being built next invite our attention. These differ from those which obtain in many parts of England, and, though they may at first sight appear to lie a little outside your legitimate province, they will be found to bear directly on the subject before us, and exert so bad an influence on London houses that you must permit me to lay a hurried sketch of them before you.

It is not the custom in London to buy freehold land for building purposes, unless it be for a public building. Land for dwelling-houses is always taken on lease. The usual term is a remarkably short one. Eighty years is looked upon as a very long term indeed. Sixty years is a very usual term, but fifty, or even forty years, are not unusual. Building leases rarely contain any provision for renewal or extension of the term, so as a rule the transaction amounts to this, that the freeholder lends his land for say sixty years on the conditions that he receives an annual rental, that buildings such as he approves are put up, and that at the end of sixty years the land, with the buildings on it, reverts back to him. There are also usually, covenants that whatever is erected shall be kept in repair by the person building, fair wear and tear excepted.

The rent charged for the land is termed a ground rent. It varies according to the situation, between the extremely wide limits of half a penny, or less, to half a sovereign, or more, per superficial foot per annum; but in ordinary practice for dwelling-houses it is about one-sixth to one-eighth of the rental, which will be obtained for the house from an occupier, and it forms a first charge on the house, so that, if it be left unpaid, the freeholder can seize the house. As a consequence, ground rents, being very amply secured, usually command a high price in the market.

Let us suppose the owner of land bringing in an agricultural rent as pasture-land finds that one of the railways which connect the suburbs with London is making a station near his property. His land immediately becomes eligible as building-land, and is thrown into the market, with the result that, sooner or later, and without any expense to him, it is let. Ordinarily, a large plot of such land is taken by a speculative person, or middle-man, who can command a little money and understands this kind of business. The middle-man makes roads, and perhaps drains, and lets plots fronting these roads to

builders, who, with borrowed money, proceed to erect houses, If the speculation succeeds these houses in due time find tenants. and immediately after that the series of interests thus created are usually sold by the persons who created them, to other persons, who buy them purely as commercial speculations or investments. The freeholder gets for his share ground rents, created without expense or trouble of any sort, and his share is a very saleable commodity, while, sixty years hence, or so, the entire estate, with the ruins of the houses, will fall into the hands of his representatives. The middle-man, who has had much more trouble and some expense, has also a share, sometimes a considerable share, of the ground rents, for he arranges to let the ground in plots to builders for considerably more than he has to pay for it as a whole. These enhanced ground rents he sells, and this concludes his share in the whole transaction. More eager sellers than the middle-man, and far more eager than the freeholder, are, however, the actual builders, who are, generally speaking, men with no capital of their own, trading on the verge of bankruptcy, and depending for their profit mainly upon their being able to sell such interest as they have in the houses they build promptly, and for a sum larger than their outlay in building materials and wages, plus the repayment of borrowed money, interest, and professional charges.

Such is the machinery by which the larger part of the dwelling-houses in London are erected. Let us see now how it works—for the good or ill of the tenant.

First it provides him a house of some sort at the point where he wants it, and with about the requisite number of rooms; and I will go so far as to say that it provides the average Londoner with a house that seems to suit him, for houses thus built are readily taken but it will be seen that there is absolutely no one whose permanent interest it is that the buildings shall be sound, sweet, and safe to occupy. The original landlord is sure of his ground-rents and has no further interest, the middleman when he exists, and the builder, at any rate, seek to release themselves from any connection with the property at an early day, and the unlucky tenant, still more unlucky if he has bought the lease of his own house, finds that there is no one to whom he can turn for any redress or remedy, whatever goes wrong.

There is, indeed, one advantage which, on estates, when landlords have a sense of public duty, the system of building leases does possess, and it is this:—

The landowner can lay down the conditions under which alone buildings shall be put up, and can enforce them; but for one who does so in the interests of public health and for the

welfare of the future occupiers of the houses, ninety and nine only frame such regulations as conduce to the benefit of their own pockets, and are careful to shackle the speculating builder with few or no conditions of a character which he might consider onerous, and which might consequently induce him to transfer himself and his building operations to some neighbouring estate.

It may, perhaps, be asked where in this system does the architect come in? My answer is, nowhere. The bulk of London houses are not designed by architects and not superintended by them. The first and last time, when any architect looks into them with a critical eye is in too many cases only when they are offered as security for a mortgage, and a professional opinion, not upon their sanitary state, but upon their commercial value (a very different matter) is asked for. I am anxious to put this upon record, because persons occupying houses full of defects are only too apt to take it for granted that some member of the profession to which I have the honour to belong must have been charged with the supervision of the row or square in which they dwell, and that to this unknown architect's neglect of a duty which was never cast upon him are they indebted for attacks of typhoid or diphtheria, or the risk of them.

V.

Let us now turn to the actual London as it has grown up under the conditions I have endeavoured to sketch. To accomplish this I will invite you now to accompany me on a short tour of inspection among dwelling-houses of various classes in the centre and suburbs of London.

We will begin with a house of the very first class, with the condition of which I am well acquainted, one occupying an exceptionally good and airy as well as fashionable situation. This house has had for tenant one person at least of the very highest official and social position. It has been built probably about fifty years, and is one of several forming a row. The first floor contains a magnificent suite of reception rooms, and the whole is a residence fit, and only fit, for a nobleman. Here we shall find some of the bedroom, and many corridor and closet windows opening into areas of great height and comparatively small dimensions, one closet with no external light or opening of any sort, two storeys of basement rooms and vaults where air stagnates and cannot, except to a very limited extent, be changed, and drainage presenting nearly every defect that could be met with. The main drain ran from back to front under the basement floor. It was originally a brick drain, but part of it had

been carelessly replaced by tile. The brick portion had leaked on all sides, and there was a foul accumulation under the floors of several basement rooms. Sinks, with direct communication with the drains, were furnished solely with the traditional bell trap, and on the first floor a bath had been placed in a dark recess out of the principal bedroom, with waste and overflow pipes taken into the drainage system and trapped; but as the bath was rarely used the traps were all dry, and so a constant stream of sewer gas was poured into the room, where probably during the greater part of the winter a fire would be kept up to insure its being drawn in at a brisk rate. Overflow pipes from cisterns were taken direct into places from which contamination was inevitable, and, if the colour of the scum on the top of the water was any clue, did rise. There was no ventilations of drains and no disconnection of sinks.

Of course many of these defects admitted of a remedy of one sort or another, and I trust that none of them that was remediable could be found to-day if you went to look for them, but I quote them as shewing what existed till very lately in one house of a high class, and undoubtedly exists in many others of the most commanding exterior, and for that matter, interior also.

Take another case of a moderate-sized family house, probably rather older than the last, and in the neighbourhood of one of the West End squares that passed through my hands for additions and repairs some years ago. I hardly expected to have to re-model the drainage, as that was understood to have been done; but in the course of the work the floor of the kitchen, a building on the basement level and behind the main house, was taken up to put in an underground flue. On opening the ground, so bad a smell was met with, that a thorough exploration became necessary. The whole basement floor was taken up, and it was found that the house stood on four feet of made ground—that is to say—material brought to the site. This material appeared to have consisted of the emptyings of cesspools, and the scrapings of roads in about equal proportions, and the walls had actually been built on broad platforms of plank floated on the top of this soft pestilent mess. The whole was removed, the clerk of works being, by-the-bye, nearly killed by the effects of the bad air inhaled, and all the walls were underpinned, and that house is sound and sweet; but it has neighbours right and left of it, and for anything I know to the contrary, they stand on exactly the same mouldering mass of corruption which underlay this one.

Come to such a house with a shop as we shall find in any street in the West-End of London. The shop occupies the whole of the plot of land, having been pushed as far back as

possible, over the back-yard or garden, to make as much room as could be got. Below it is a basement all but devoid of air, getting some light, however, at the front. The area into which it opens has been partly paved over leaving an opening with an iron grating which has been recently removed, and the opening covered with patent reflecting glass lights impervious to air. A series of vaults under the foot pavement of the street open out of this area, and if one of them is a coal-cellar, the other usually contains a closet and a foul dustbin, and a gulley grating, probably broken, allows the drain below to add a fine flavouring to the choice collection of smells derived from other sources. This basement is often used as a kitchen, and it will be well if we do not find hidden away in some damp and dark corner the servant's bedstead.

The upper rooms are used as living rooms, or let as lodgings, and in the top storey under the slates, cold in winter and hot in summer, is a series of attics, where those who sleep in them are at the mercy of every wind that blows.

Now come across the Thames with me, and let us pay a visit to the houses of the very poor in Lambeth, or Southwark, or Bermondsey. We shall find large spaces thickly covered by dingy two-storeyed houses, in many cases fronting to thoroughfares so narrow and tortuous that they clearly were once country lanes built upon as the need for houses arose, without any attempt being made either to straighten or widen them. The houses mostly consist of six rooms—three on a floor. But here and there are smaller ones of four rooms only; while, sometimes, a few three-storeyed tenements break the line. The storeys are low, rooms small, walls thin—one brick thick only, bulged, cracked and falling, and mortar decaying out of the joints; the roofs are covered with tiles, and let the water in with every shower; the plaster is falling from the ceilings and partitions, the walls foul with smoke and dirt, floors worn out, windows decayed and rattling in their failing frames, hearth-stones cracked and stove grates broken; sink and scullery, where there is a scullery, foul and appendages filthy, and bordering on ruin; cistern small, dirty, exposed to the air, and placed where it is most likely to get contaminated—often only one between two houses. The whole place is enough to break one's heart and to drag down the people who live in it to degradation.

It has from time to time been my duty to visit houses as bad as this, if not worse. Every room would be occupied by a different family or lodger. And I am bound to say that while it is almost impossible to fancy degradation much lower than I have seen in some inhabitants, in not a few instances it has been clear that even the depressing surroundings, if they preyed on health

and spirits, had not been able to extinguish self-respect. I have often come upon one room in such a house neat, clean, newly papered and freshly plastered by the hands of the tenant himself, or herself, a flower-pot or two in the ricketty window, and a bit or two of furniture, that if it has seen better days, is still respectable and serviceable; and I have felt that the people whom even this class of hovel could not kill and did not degrade were worthy of something more like a home.

It will hardly, I think, be necessary to take you through a longer series of individual cases to induce you to believe that much of the older parts of London consists of houses that are unhealthy owing to defective sites, bad drainage, bad plumbing, defective water storage, the absence of proper air space, the dampness and foulness of basements; the unsoundness of attics and upper storeys, and the narrowness of the thoroughfares in which they stand; and this, notwithstanding the exceptional occurrence, in some localities of fine old houses admirably built, and with good spaces in front and rear.

The outskirts and suburbs, on the whole, present at first sight, a more encouraging aspect; and dwelling-houses are no doubt better situated as regards air space round them, and to some extent enjoy a purer atmosphere; but the extent to which systematic neglect of proper precautions and the paring down of everything, to the minutest shed is carried, is almost incredible. All those appliances connected with drainage and water supply which we, in our wisdom, consider it best to hide from sight, are almost always ill-done, and generally ill-understood, so that a direct danger to health lurks behind skirtings and pipe-casings, and below the floors of many a showy suburban villa, or neat semi-detached residence, although it may be cleverly enough planned, prettily papered, and tidily painted, and generally attractive looking.

A very large number of dwellings for the working classes have been erected in the suburbs of London, and though these are not free from defects of many sorts, and are always very cheaply put together, yet, owing to the comparatively wide space of land in the shape of forecourt and back-garden belonging to them, they are far more healthy and better than the houses which operatives occupy in the heart of London. They are almost always constructed two storeys high, and are built to be occupied by two families. Thus a six-roomed cottage will divide into two three-roomed tenements, identical, or nearly so, in plan, and having separate access to the back yard or garden. Many of these are outside the metropolitan area, and have been very ill looked after; but where they stand within the boundary, or in those suburban localities where the supervision has been

strict, they really form fairly healthy and comfortable workmen's houses.

VI.

Having now pointed out some of the evils under which residents in the Metropolis suffer, I wish, in conclusion, to draw attention to some of the remedies.

It will be understood that I do not much advocate fresh legislation, unless, indeed, for such special objects as are definite and as cannot be compassed otherwise. There is a great deal possible with existing Acts, especially if every district round London were to carry out its duties, and avail itself of its powers under the Public Health Act to the full, and if the Model Bye-laws of the Local Government Board were uniformly adopted and efficiently carried out. The true cure for many of these evils is, however, to be sought in the operation of an enlightened public opinion. When once the public learn to call in the aid of the Medical Officer of Health or the Inspector of Nuisances when anything is seriously wrong, we shall be on the way to improvement; but if we can once create a demand for healthy houses, and induce people to look out for sanitary provisions as they now look out for pretty wall-papers when taking a house, the battle will be won. The moment it becomes the interest of persons who own or build houses to supply a healthy article, because anything else will not command a market, healthy houses will be built; and a society like the one which has called us together this day is likely to be of inestimable service, not to London only, but to all England, if it will but continue to rouse public attention to the dangers of unhealthy dwellings and to put forth reliable information as to the defects of bad, and the merits of good modes of sanitation.

I look for great benefit from the action of those societies which have devoted themselves to supplying sound advice on the sanitary state of dwelling houses. The Sanitary Assurance Association, with which I have the honour to be connected, and the kindred societies, by their very existence, act as a warning to the householder that danger is to be apprehended, and by their organization afford him reliable advice and assistance on matters with which he is not himself able to deal.

The erection of houses in flats, though familiar enough in Scotland, is a novelty and in some respects an improvement in London.

It began with buildings for labourers' dwellings, and has now extended to middle-class, and even to highly-rented dwellings.

It has been very much overlooked by philanthropists and others that buildings in flats are entirely opposed to the pre-

judices of Englishmen of every class, and that nothing but the kind of inexorable pressure which the exigencies of life in a great city seem to exert would probably ever have induced London people to take to them; though there is little reason to doubt that once fairly tried, they will be found useful by rich and poor alike. We think when we have erected a pile of comfortable dwellings that the people for whom they are intended will flock to them, but the average London artizan will say, if he follows the impulses of his habits and prejudices, "Thank you, I am not going to live under the care of an inspector in a place which looks for all the world as if I was in the workhouse." And his employer, if we have been building a bigger class of flats, will say: "I don't care to occupy a place that looks as if I was stopping at a hotel. I can afford to pay for a roof of my own over my head, and an Englishman's house is his castle."

In spite of this very serious drawback flats have, in a rather long series of years, lived down part of their unpopularity. There are many persons, in every rank of life, to whom it is a matter of necessity, and many more to whom it is extremely desirable, to live within a quarter of a mile of a certain spot; and some of these will sooner live in flats than migrate if nothing but flats are to be had. The better educated middle classes also, of course, include many who have travelled and seen how people in the cities of Scotland, France, Austria and America willingly occupy residences of this sort.

Houses in flats enable a larger number of persons or families to occupy an eligible site than could do so before. They have generally, if not always, been designed by architects and built, not by speculators, but by *bona fide* contractors, and under the superintendence of the architects who designed them; so the public has some guarantee of their being well contrived and soundly built. The walls are necessarily thick, the sanitary fittings are generally thoroughly good and in good order, and the whole structure is better than the usual London house. The upper floors at any rate give, in addition to warmth and dryness, a rather purer air, and catch more sun, and if the house be constructed with a lift, as is becoming usual in the largest of these establishments, these floors are as thoroughly accessible as the lowest ones.

Without denying that something of prejudice has to be overcome, and that there are reasonable objections upon which that prejudice is founded, which must be waived in view of the great advantages of the system, I have no hesitation in saying that the occupants of well-built flats are, on the whole, in much better sanitary circumstances than the majority of their neigh-

bours in adjoining streets, who occupy rows of ordinary dwelling-houses.

Something may be hoped also from the creation of joint-stock companies undertaking building speculations. There are many so-called building societies in London, but most of them are only buyers of houses, and a badly built house, if it is sure to command a rent, will not be declined because it is insanitary. At present the operations of joint-stock companies have been mainly restricted to labourers' dwellings, in erecting which they have built in a far sounder manner than private speculators, and yet have mostly managed to realise a fair profit. The building of ordinary houses in the suburbs, and of houses in flats at the main centres of London, is a great field open for such enterprise well directed; and there can be no doubt that a good public company building as an investment, might erect houses, which, from their sound construction, would be a great boon to the householder, with a very fair prospect of profitable return.

Some very large private firms or individuals have of late become engaged in the business of supplying London with houses. Some of these are doing their work well, and are becoming alive to the fact that a sound healthy house is an article which will, sooner or later, as sanitary knowledge extends, be at a premium, if its excellencies are not much appreciated yet; and as some of these people fortunately build, in part, at least, for investment, the worst of the evils of the leasehold tenure system are likely to be by degrees overcome. If it were possible to render leases for long terms customary, and to make landowners sensible of the responsibility which really rests upon them in respect of the houses they allow to be built on their land, and if, in addition, we could induce capitalists to build as an investment, so that they would have a direct interest in the solidity of what was put up, then surely we might hope that what remains to be built or rebuilt in London, would be better fitted for living in than the houses hitherto erected.

But there remains one part of the community whose case, already glanced at in one of my descriptions, is so bad that no amount of public opinion, thought and care had for a long time proved able to effect a radical improvement, and so desperate that London cannot afford to wait. I allude to the operatives' homes in those old parts of London where the streets are narrowest and the houses worst. This question has forced itself upon the attention of the legislature, and will probably be soon again before Parliament. Its merits and the circumstances connected with it are probably too well-known in this room for it to be

necessary to state them at any length, but my address would be incomplete without some short account of what has been done to improve the dwellings of London working people during a period which may be approximately stated at nearly, if not quite, fifty years.

This movement began in a very moderate way, and has gone on steadily increasing. The promoters of it have been doing good work, partly by spreading information and influencing the public mind, but chiefly by improving existing tenements or erecting new ones for the accommodation of the industrial classes. We have to recall the efforts of pioneers like Mr. George Godwin, Sir Robert Rawlinson, and Mr. Edwin Chadwick; the unostentatious labours of Miss Octavia Hill, and the band of energetic workers whom she has called round her; the commercial companies started, like the one inspired by the zeal of Sir Sydney Waterlow, with the avowed object of showing that improved dwellings for the poor can be made to pay; the private speculations that have followed in the wake of these companies, and the labours of the great corporation established to administer the munificent gift and subsequent legacy of Mr. George Peabody. These have all contributed to an aggregate result which has reached larger dimensions than many are aware of, and which is swelling year by year.

In the summer of 1881 the amount of accommodation provided by public or semi-public agencies in London reached 11,000 families, or estimating an average of 5 persons in a family, 55,000 persons, at an outlay of about £1,900,000; and there were buildings in hand, or recently erected by private builders, and by the Peabody Trustees which might be estimated as involving an outlay of not less than £900,000 more, and calulated to increase the accommodation by probably 27,000 persons. I am not prepared to say that the whole of this large estimated increase, that is to say up to 82,000 persons, has as yet been realized, but the greater part of it has, and probably not fewer than between 70,000 and 80,000 persons now inhabit the improved dwellings provided by these agencies, nearly the whole of them being moderately lofty dwellings, arranged as flats, and with common staircases.

The urgent need of improvement in the dwellings of the working classes in London and elsewhere, and the difficulty of attaining it have been recognised as so serious that repeated Acts of Parliament have been passed to facilitate the work. I will condense from the interesting Report of a Committee of the House, on Artizans and Labourers' Dwellings, dated 19 June, 1882, the account there given of the chief Acts.

Mr. Torrens' Acts of 1868 and 79 "proceed upon the principle

that the duty of maintaining his houses in proper order falls upon the owner, and that if he fails in his duty, the law is justified in stepping in and compelling him to perform it. Under these Acts, if an inhabited building is found in a condition dangerous to health, or to be unfit for human habitation, the local authority has power to order the owner to remove the premises or to execute such alterations as are necessary, and in default the authority may shut up the premises, or pull them down, or execute the alterations at the owner's expense." The Act of 1879 further gives the local authority power to purchase the premises, and to hold them in trust so far as the Metropolis is concerned: 1st, for providing suitable dwellings for labouring people, either by way of improvement or by rebuilding; 2nd, for providing open spaces.

These Acts have been used to some extent in London, but not at all to the extent to which they ought to have been. The local authorities on whom the burden and expense of carrying them out would fall have frequently held their hands, hoping that a Metropolitan improvement (under Mr. Cross's Acts, about to be referred to) would undertake the matter for them. And I fancy, also, that unostentatious quiet work, such as these Acts permit, is a little apt to drag, unless some external influence is brought to bear. Perhaps the best thing that could happen would be for the administration of these Acts to be transferred from the Local Boards to the Metropolitan Board to be by them carried out much in the same way as those clauses of the London Building Act which relate to ruinous and dangerous structures.

Mr. Cross's Acts of 1875 and 1879 are better known, and the action taken under them is much more conspicuously before the public. "They contemplate dealing with whole areas where the houses are so structurally defective as to be incapable of repair, and so ill placed with reference to each other as to require, to bring them up to a proper sanitary standard, nothing short of demolition and reconstruction; accordingly in this case the local authority, armed with compulsory powers, at once enters as a purchaser, and on completion of the purchase forthwith proceeds to a scheme of reconstruction." At the date of the report already quoted, namely, six years after the passing of the principal Act, only fourteen areas had been dealt with by the Metropolitan Board under these Acts, but great and, to some extent, unexpected delays and difficulties have been experienced in carrying the Acts out, the most serious difficulty being the enormous expense. Thus, these fourteen areas, containing about forty-two acres, have cost to acquire no less a sum than £1,662,000, including expenses and the formation of

streets. These streets have absorbed about nine acres of the land.

The Act of 1875 imposed the obligation to house on the sites cleared as many persons as were displaced; 20,335 persons were displaced, and provisional orders for providing accommodation for 22,753 persons were confirmed by Parliament. It has been found quite impossible to induce the Peabody trustees or any of the companies that build labourers' dwellings to pay a price for this land approaching the cost of it or its value for commercial purposes, and as long as the acquisition of it is coupled with the condition that the buildings are to be always used as operatives' dwellings this must always be the case. Accordingly the land sold has been disposed of at about one-third of its commercial value.

The estimated recoupment is about £370,000, leaving a net loss of £1,211,336, or, if the cost of making new streets be not included in the transaction, £1,115,836. Had the necessity for retaining workmen's dwellings always on the site not existed, it is estimated that the loss would have been £560,000 less.

The bare mention of these figures shows that such work must take a long time, and involve an immense outlay of public money. Probably it is worth all that it costs, but its serviceableness to the poor is very much interfered with by the fact that large areas are cleared of their inhabitants at one time. The people who are turned out have to crowd in where they can, and those who cannot migrate to the suburbs—the very persons whom it is intended to benefit—are subject to the most serious inconveniences; long years pass before the new buildings are erected on the spot, and by that time most of the individuals displaced have taken root elsewhere, so that very few of them are found to re-occupy the area. Nor is it clear that the new accommodation is adapted to their wants. I am of opinion that even the tenements built by the Peabody Trustees, and unquestionably those built by most of the societies, are too good for the very poor, and that from these two causes, though no doubt we are improving London, we are not improving the condition of the labouring and poor inhabitants of the very areas which are dealt with.

The Metropolitan Street Improvements Act of 1872 also bears upon the question before us, but not so directly, and it is hardly necessary to prolong this address by referring to its operation.

In bringing these observations to a close, I cannot but express my regret that the account which I had to give of the dwelling-houses which go to make up the richest and largest city in the Western World could not be more favourable con-

sistently with truth. One thing at least is clear. London affords now, and must for years to come afford an ample field for the energies of those who devote themselves to the pursuit of sanitary science, the diffusion of sanitary knowledge, and the performance of sanitary work. The cry for help is a loud one, and, believe me, legislation is almost powerless to render that help, even if political strife left our statesmen any leisure for domestic improvements. But the good done by an organization which will set public opinion in motion, and keep it going, which will be unwearied in its warnings, its exhortations and its diffusion of sound information must, in time, be simply incalculable. The average London house can never be made thoroughly strong and sturdy till the happy moment for pulling it down and erecting something better arrives, but it may, generally speaking, be made safe to live in by a moderate outlay, if directed wisely. If, then, it is in the power of each householder to make his home safe, our duty is plainly—first, to give him no rest till he wakes up to the necessity of so doing, and then to diffuse correct information so widely that there may be little difficulty in his finding out what it is that he ought to do. Let me, therefore, in conclusion, heartily congratulate this Congress on the important work which lies before it, and urge the Congress collectively, and every member individually, not to relax their exertions in this good work, and especially to direct their best efforts and their most strenuous exertions to the advantage of the unfortunate inhabitants of the Metropolis of Great Britain.

Dr. RICHARDSON, F.R.S., said the members of the Congress might congratulate themselves on hearing the address that had been read, because he was quite sure that when in the future the history of this country came to be written, and London to be described, that essay would be looked upon as quite historical. A more faithful view of the condition of London he had never listened to, and he did not think there had ever been a more faithful record put upon paper. He said so with a conversance of London which few men possessed. London was to him a great field of observation, and he confirmed all that Professor Roger Smith had said in regard to its present condition. When they went into the houses of the upper class, the houses of the middle class, or the houses of the poor, and of the very poor, those pictures which Professor Smith had described were seen. Amongst the better-class houses things were often worse than in those of middle class. He had within the last few years visited a house where fourteen persons could sleep in the basement, truckle

beds being fastened to the wall to admit of their being folded up during the day. There was no privacy nor ventilation nor any idea of cleanliness in such apartments. In a very large house, where he went to see a case of typhoid fever, the very cushions of the fine drawing room were odorous, not of perfume of flowers or anything sweet, but of the sewer; and in that case—and the same could be said of a number of houses in the same terrace—the soil pipe was full up to the water-closet. In another house, in which he himself had some interest, they opened a drain which was eighteen inches square, extending from back to front, and from it removed fifty barrow-loads of retained sewage. That was a representation of what might be called one of an order of first-class square houses; and how far such evils extended through London it was impossible to say. The wonder was that London was so healthy. It seemed incredible to him that London should present a mortality of no more than 22 in the thousand per annum, and it showed how pre-eminently healthy it would be if it could be given a fair chance of healthiness. If they, as a Sanitary Institute, could have their own way, they would soon bring down that 22 per cent. to 15 per cent. in the thousand annually.

It seemed almost impossible during the present time, when the land difficulty was so pressing, to do anything that was practical in London. He would go farther than Professor Smith, and say that the weight of the difficulty which had now to be met and contended with lay in the length of leases and the distribution of property. No man would bestow much money or care in erecting houses till the time came when he should be able to build for more than 40 or 50 years. The great reforms in London buildings must first take place in reference to the distribution of landed property. That done, he thought the difficulty would soon be solved. The people were beginning to call out for themselves, and amongst the poor and working classes of London there was a general feeling, now that they were becoming educated, not only that they ought to have that which they wished, but that they would have it; and that they would force their wishes from unwilling hands was one of the things which might be regarded as a certainty. He proposed that a most cordial vote of thanks be accorded to Professor Smith for his valuable communication.

Professor F. DE CHAUMONT, M.D., F.R.S., seconded the motion. He said that the paper read by Professor Roger Smith was one of extreme value. Although it might be thought that an address in Glasgow on the subject of London dwellings was perhaps of less interest than other subjects, that would be a wrong view to take of the case. Though the paper had special reference to London, its principles were applicable to every city in the kingdom. He thought that he might also remark with reference to some somewhat sharp criticism upon the work of the Congress yesterday which had appeared in the press that morning in reference to the character of the papers which had been read and the discussions that had taken place at the Congress, that the object of the Sanitary Institute was not to be running

about to find something new to present to the public, but rather to keep on "pegging away" at those very truths and points to be attended to, but which were not attended to. It might be certainly a little uninteresting to hear that houses ought to be clean; that sanitarians ought to be patient; that drains ought to be trapped, and so on. The thing had all been said before; but, as he had already remarked, the thing was not being *done*. Not only so, but as it would not be done unless they went on, as Shakespeare said, with "damnable iteration" calling attention to it, it was perfectly clear that it was their duty to bring these subjects before the public as well as more general principles. The paper read by Professor Roger Smith would, he thought, fully justify the conduct of the Congress. He did not mean to say that their proceedings were beyond criticism, but at the same time he thought the view that had been taken of them was a limited and erroneous one, and if it were reconsidered, he thought it would be seen that their proceedings were not perhaps of the small interest and slight usefulness which it had been hinted they were.

Professor HUMPHRY said he did not think anything could be more important than the exposure of the evils that were found in the houses of the Metropolis that had been made by Professor Roger Smith. London was becoming more and more important to the empire, not only on account of the vast numbers that are accumulating in it, but also from the fact that it would be more or less an example to all other towns in the kingdom.

Professor ROGER SMITH, in acknowledging the compliment, said, with regard to what Dr. Richardson had said upon the very low death-rate of London, that was of course partly due to its certainly favourable conditions of climate, but they must not forget that the wonderful increase of London was necessarily the cause of a low death-rate, because almost all the people who come from the provinces were in the prime of life, and had passed all the dangers of infancy and childhood. The increase was one of perfectly healthy people, and but for that he was afraid that London would not be found quite so salubrious a city as the study of statistics alone would make them believe.

On "The advantages of Low Ceilings in Small Houses, by JOHN HONEYMAN, F.R.I.B.A.

The height of the ceiling affects both the owner and the occupier of a dwelling, but chiefly the occupier; for whereas it affects the owner's pocket only, it affects both the pocket, the comfort, and the health of the occupier. If the owner is perfectly free, he will simply adopt the height of ceiling which

he thinks will enable him to get the largest return from his property. It by no means follows that he will adopt a low pitch. He may think that high ceilings will make his houses more attractive; in certain circumstances yielding higher rents, or at least securing a better command or a better class of tenants. But if the ground he builds upon is dear, and the demand for houses great, he will be tempted to make the storeys low and increase their number; and in so doing he will be doing what is at once best for himself, and also—unless he make the rooms small as well as low—what is best for the community.

But in most of our large towns and populous places a person about to build is not free. He must build in conformity with regulations limiting the total height of his building, and prescribing, among other things, the height of ceilings, and the cubic capacity of rooms. Hampered by such restrictions he cannot suit his houses to the requirements of the districts where they are wanted; he must make them as Parliament has been pleased to prescribe, however extravagant or unsuitable for the people who require them, and he must get a profitable return for his expenditure from these very people who don't wish extravagance, and can't afford to pay for it, but who in the circumstances either *must* pay for it or do without dwellings. For example, if the Police Bill drafted by the Corporation of Glasgow became law, a man having land bounded by a new street forty feet wide would not be allowed to erect a tenement of dwellings in that street more than two storeys high, with this necessary result that his return for the cost of land and buildings must be got from two tenants instead of from four or six. If left to his own discretion he would, at a small additional outlay, make his buildings say four storeys high, and—profitably to himself—accommodate on the same ground twice the number of tenants at lower rents. Now, assuming that the four houses, or storeys erected in this way were as good as the two made in conformity with the Police Bill, it must be perfectly obvious that, whether the owner made more out of the transactions or not, the erection of the four would be distinctly most advantageous for the tenants, and therefore for the community at large; because in this way twice the number of people would get accommodation where they want it—not where the Corporation say they ought to want it—and they would get it at a greatly reduced rent, both, I submit, considerations of the very greatest importance, and having a direct bearing on sanitary questions of great interest. Of course, if it could be proved that high ceilings and low tenements were essential to secure healthy conditions, a great deal could be said in favour of compulsory sanitation in that direction, although

even in that case I should be prepared to say a great deal against it; but it has been abundantly proved—and this was very clearly brought out at the Newcastle Congress—that there is no necessary connection between density of population and a high death-rate; and, I may say, that the very same statistics—namely, those of the various Improved Dwellings' Companies—which most conclusively prove this, as conclusively show that there is quite as little connection between low ceilings and a high death-rate; as in all these dwellings the ceilings are low and the storeys numerous. Most people however, in this part of the country at all events, I may venture to say most sanitarians, still cling to the idea that—*cæteris paribus*—a room with a high ceiling is a more healthy dwelling than one with a low ceiling. Now, I wish to strike at the root of this prejudice which as affecting legislation has had and may—unless eradicated—still have most pernicious results; and I hope to be able to prove that, other things being equal,—that is, that, given two rooms of different heights but of the same capacity, having the same size of chimney opening, the same area of window, door, and vent openings, the lowest will be the cheapest, the most commodious, the most comfortable, and the healthiest dwelling of the two.

I shall dwell chiefly on the sanitary aspect of the question, merely devoting a sentence or two to the other important points I have mentioned. One of these, the greater extent of floor area in a low than in a high room of the same capacity, is self evident, and the advantage of this to the occupant is equally obvious. The economy of the low pitch is not quite so readily understood. For the sake of illustration, I have calculated the rents which must be charged for houses of 2,000 feet capacity in order to yield 5 per cent., arranged in three different ways—First, in tenements of two storeys of ten feet; second, in tenements of three storeys of eight feet; and, third, in tenements of four storeys of eight feet; allowing a proportionate area of vacant ground in each case; and I find that in the first of these—the two-storey tenement—the rent would require to be £9 6s. 0d. in the three-storey tenement it would be £8 5s. 0d., and in the four-storey tenement, £7 14s. 0d.; so that the artizan contented with an eight feet ceiling, might have a roomier house for £7 14s. 0d. than he can possibly get for less than £9 6s. 0d., where restrictions already referred to exist. In other words, he is compelled to pay £2 8s. 0d. per annum, or fully a third more than might otherwise be required, and at the same time he must be content to occupy a smaller house in a less covenient locality, without one solitary compensating benefit, merely because some sanitarians, chiefly municipal, think such treatment good for

him. To my mind it is unmitigatedly bad, and a very serious matter for our working classes. For observe, it is impossible to take this £2 8s. 0d. out of the owner's pocket, the tenant must pay every penny of it, as of course, no builder in his senses is going to put up dwellings which will not yield him 5 per cent. at least.

But the important question remains—would the low house be healthy as well as cheap and roomy? In my opinion it would, and in a greater degree than the high house. The means of ventilation, which alone are admissible in such dwellings, being of the simplest possible kind, it will be found that it is easier to ventilate a low room than a high one by their agency. Practically, the ventilation must be effected by the admission of fresh air by doors and windows—or round these when closed—through the badly fitting joints of floors and skirting boards, or by special inlets not intolerable to the inmates (if such can be devised) and the extraction of air by the chimney. Such means have been found sufficient, except where apartments are overcrowded, that is, except where the chimney is insufficient as an extractor. We may take it that in any room having a door, a window, and an open fireplace, three or four people may sleep safely, and the condition of the air will depend not so much on the capacity of the room, as on the area and draught of the chimney. Those who are familiar with the subject will, I trust, excuse me if I say for the information of others in this mixed audience, that even such a capacity as is prescribed in our Police Bill—400 cubic feet to each adult—is utterly insufficient unless we have along with that a constant and rapid change of air. But to effect this change so that the whole volume shall be kept up to a safe standard of purity, it is necessary that the fresh air should be properly distributed and permeate the whole apartment. This point I fear is sometimes lost sight of. For example, if we take a room of 2,000 cubic feet with five inmates, to keep the air, not as pure as we could wish, but in a tolerably healthy condition, at least 5,000 cubic feet of fresh air would require to be passed through the room per hour; and as an ordinary open fire will easily extract that quantity, there seems to be no great difficulty about it. But, observe it is quite possible to pass all that quantity through the room without pnrifying the atmosphere in any appreciable degree; we may let it all in at one side of the room and up the chimney at the other, leaving the air breathed by the inmates impure and poisonous, perhaps fatally; so that the more complete the distribution of the fresh air, the more beneficial will the ventilation be. Now the facility of distribution will depend to a large extent on the form of the room. If the room (always

bearing in mind that we are speaking of rooms of the same cubic capacity) be high in proportion to its area, and the fresh air be admitted in the usual way referred to, the lower part only will be ventilated, and a large proportion of its atmosphere will remain impure; whereas, if it be low in proportion to its area it will all be well ventilated, and the inmates will get the full benefit of the room's capacity. In the other case they would not, as a considerable proportion of the high room would remain stagnant and foul—a condition objectionable on other grounds.

But—it may perhaps be said—granting that the air in the upper part of the room, say a fourth part of the total volume, remains unaffected, and that the 5000 feet per hour allowance is distributed in the lower part only, is that not exactly where the fresh air is wanted? Certainly, but fresh air is not *the only thing* that is wanted in an artizan's house. Warmth and freedom from draughts are only second in importance—if, indeed, they are second. There are delicate women and tender babes to be considered, as well as robust men, and our mortality tables painfully remind us of the fact that that consideration is far too much overlooked. No doubt by the passage of a given quantity of air through a room you can make a part fresher than the whole, but it is evident that as you reduce the part affected you necessarily increase the velocity and lower the temperature of the current; indeed, you can, without difficulty, carry this reduction so far that with the aid of a good-going fire, you may obtain a very high standard of purity, and a cold draught, of perhaps 150 feet per minute, in the only habitable part of the room, that is in the only part where the air is fit to be breathed. Our object of course must be to make every part of a room habitable, and to leave not one stagnant corner in it. In this way alone can we secure in the highest degree both essentials of a healthy dwelling—pure air, and warmth. Now, we shall find that the lower the ceiling the more easily can this combination be secured.

Let us look a little more particularly at the superior facilities which the low room offers. The top of the door, from which I think the greater part of the air required should come, is necessarily near the ceiling, and the current will therefore completely disturb the upper stratum of air. The air from the window will have the same effect in a smaller degree, and both currents will be warmed by contact with the ceiling. We need never look to the floor as an air-warmer, except to a limited extent near the fire; a much larger area of the ceiling is heated, and in a low room there is not only a much larger area of ceiling to heat than there is in a high room, but the radiant heat upon it being more intense, it becomes an air-warmer of immensely

greater power; and, obviously, this extra power in a low room can be used either to raise the temperature of the room, or to raise a larger supply of air to the same temperature. Besides, if in this way we are able to admit more fresh air near the ceiling, we shall also, in like proportion, be able to reduce inlets at a lower level, and to that extent get rid of cold draughts. Practically the quantity which can safely be admitted is limited by the means of warming it—the more we can warm, the more we can safely admit I insist very much on the importance—the absolute necessity—of this heating in connection with the ventilation of small houses. Some people seem to think that hot air and foul air are synonymous terms; it would be much more correct to say that cold air and foul air are synonymous. If the fire burns up, and the room becomes over-heated, the window will soon be opened, and even if the atmosphere remains warm it will be wholesome; but where the fire burns low, as the winter evening closes, and the ill-clad mother clasps her suffering infant to her breast for warmth rather than for nourishment, what wonder if we find the air close and impure, and every inlet crevice stopped with what we are pleased to call "perverse ingenuity?" If we wish the occupants of small houses to admit plenty of fresh air we must not only convince them that it is good for them, we must show them how to do it without sacrificing something else which is good also—which is even better in their estimation—namely, comfort.

In conclusion, I desire earnestly to invite the attention of Scotch local authorities to this subject. It is clear that if I am right in the views I have advanced—if it is the fact that from a sanitary point of view, a low ceiling is as good as a high one—much more if it is better—municipal authorities are utterly wrong when they prevent by legislation (as some have done, and others wish to do) the erection of low-ceilinged houses. It simply comes to this, that by such regulations they wastefully increase the rents which the working classes must pay for house accommodation, and thereby in the most direct manner encourage over-crowding with all its attendant evils; while at the same time they effectually prevent the erection of improved dwellings, such as are now common in London and elsewhere in England. Within the last few weeks I have seen in a street twenty feet wide, an admirable tenement of artizans' dwellings seven storeys high. According to our draft Police Bill, the height would have been restricted to one story—*one* family only would have been allowed to dwell where it has been proved to demonstration that *seven* can be housed with much more comfort and much less expense. Surely it would be difficult to imagine

a more striking illustration of the mischievous effect of misdirected sanitary zeal.

[*For Discussion see page* 216.]

On "Some Sanitary Aspects of House Construction," by WILLIAM WALLACE, Ph.D., F.R.S.E., F.C.S., F.I.C.

LAST winter I read a paper on building-stones to the members of the Architectural Section of the Philosophical Society, and the subject attracted a good deal of attention among the architects and builders in the city; especially as it had a direct bearing on the selection of a stone suitable for the erection of the magnificent pile of buildings about to be erected by the Corporation of Glasgow. An opinion was also expressed that the chemist might give valuable information, and make useful suggestions, to the architect and builder if he would devote his attention to the construction of buildings. The encouragement received on that occasion has induced me to bring before the Architectural Section of the Sanitary Institute a short paper on some of the sanitary aspects of house construction, excluding entirely from consideration the important subjects of drainage and sewerage, which I leave to others who have made them a special study.

Granting, then, that a house is well drained, and that the plumber's work is properly trapped and ventilated, what is wanted to make it a healthy residence is that it should have plenty of light, and that it should contain at all times air pure and dry, or at least as pure and as dry as may be possible. The subject of light may be dismissed in a few words. The importance of having large windows is perfectly understood, and so far as isolated buildings are concerned it is unnecessary to say anything. But as regards street architecture, it is of the utmost importance that houses should be built of a height bearing a direct relation to the breadth of the street in which they are situated; hence the paramount importance of having enacted by Parliament rigid building regulations for cities and towns, in order to prevent the erection of tenements of such a height in proportion to the breadth of the street that the windows in the lower stories get little or no sunlight. This is a subject which has been thoroughly discussed in this and other

cities, and I hope that in course of time more stringent rules than we at present possess will be enacted. A fair proportion in this latitude is that the house should not exceed in height two-thirds of the breadth of the street; thus giving three stories in height for a street of 45 to 50 feet wide, and four stories for one of 60 to 70 feet. I say, advisedly, in this latitude; for while at the equator the sun at mid-day is perpendicular or nearly so, in high latitudes it forms with the earth's surface an angle more or less acute. Hence, a street in Cairo of only 15 or 20 feet wide may be better lighted than one of 40 or 50 feet in Stockholm.* As regards the direction of a street, I should prefer to live in one placed as nearly as possible north and south: in this case, and taking the west side of the street as an example, the sun shines from morning till mid-day on the front, and from mid-day till evening on the back of the house. But in a street running east and west, the houses on the south side get scarcely any direct sunlight—in winter none at all—in front; while those on the north side are equally unfortunate as regards the back rooms. No apartment can, in my opinion, be considered a perfectly wholesome one which does not enjoy direct sunlight during some part of the day. But if an apartment must be so situated that it cannot have sunlight, it is some compensation that it have very large windows, so that it may get as much diffused daylight as possible.

Purity of air cannot be maintained in a house unless it be thoroughly dry. Setting aside the not inconsiderable quantity of water produced by our own breathing and by the combustion of gas, oil, and candles, the air in a house is liable to be rendered unwholesome from excess of moisture, 1st, by absorption of water from the rock or soil below, and, 2nd, from the porous stone of which the building is constructed. Not only is the air loaded with moisture from these sources, but it is rendered impure from the exhalations of fungous vegetation or dry-rot, which at the same time destroys the joists and other carpenter work, and seriously affects the stability of the house. It is a mistake to suppose, as many do, that dry-rot attacks only the wood in the basement storey. It is a common occurrence for the ends of joists built into porous stone to become affected by fungous vegetation; and it is frequently seen in pulling down old tenements that the ends of the joist are quite gone, and that, probably, for many years the joists have been resting only on the plaster cornices of the rooms. The remedy is the use of "shoes" of glazed

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* This subject was brought prominently before the citizens of Glasgow a few years ago by Councillor W. R. W. Smith, who obtained the assistance of Professor Grant in calculating out some facts of great interest.

fire-clay or other material, which are built into the wall, and into which the ends of the joists are placed. The "shoes" should be somewhat larger than the joists, which should be kept in position by little wedges of wood, so that air can play freely around the end of the joists. Such protected joists will last for hundreds of years, if other circumstances are favourable.

The porosity of most varieties of building stone is remarkable. In the paper to which I have already referred I have given, besides other properties, the quantity of water capable of being absorbed by the stone when air-dried. By weight it ranges from 3·4 per cent. in the celebrated Craigleith stone to 7·2 per cent. in the red sandstone found at Wemyss Bay, on the Firth of Clyde. The significance of this property of porosity is still more readily appreciated if we take the amount of water absorbed by bulk instead of weight. 100 parts by measure of the hardest and best freestone take up about 8 parts of water, and the inferior kinds 12 to 15 parts. A cubic foot of the stone will therefore absorb from 5 to 9 lbs. of water, or from half a gallon to nine-tenths of a gallon. The absorption of water by certain kinds of stone is so rapid that in slight showers of rain the whole of the water that falls is imbibed; and although a great part of this evaporates afterwards from the surface of this stone, a portion must always find its way inwards, and this is especially the case when the surface of the stone is kept constantly wet by continued rain.

Another property of freestone is its power of permitting the passage of air or other gas by transpiration and diffusion. A cube of stone varnished over on four sides and enclosed at the other two in an air-tight case provided with inlet and outlet tubes, permits the passage of coal gas to such an extent that the gas can be lighted and will continue to burn, even although the pressure is not more than an inch of water. The same thing applies to other building stones which are all more or less porous, and to bricks, unless these have been exposed to a temperature high enough to flux the material of which they are made. The quantity of air diffused into and out of a house by the walls must be very considerable, and as it is a process that is constantly going on, it must necessarily exercise an appreciable influence in maintaining the purity of the air in dwelling houses. If, however, the stone or brick be saturated with water, the porosity is, for the time being, destroyed; or if there be any air diffused at all it will be loaded with watery vapour, and therefore of less value, in a sanitary point of view, than it would be with only its normal proportion of moisture. Besides this evil, there is the more serious one of the water actually reaching the joists and other wood, such as "dooks" and wall plates and

straps, and causing these to decay, and so interfere with the stability of the structure. Coating the stone with oil, paint, silicate of soda solution, or other means of rendering it impervious to water, prevents the absorption of rain; but it also, at the same time, destroys the valuable property of diffusing pure air into and impure air out of the house. The only way that I know of for securing the advantages of the porosity of the stone and preventing the injurious action to which I have referred is to have double walls, with a space of a few inches between, into which air is freely admitted by openings in the wall at top and bottom placed in such a manner that rain will not enter by them or lodge in them. The openings may be about three inches square, and placed about six feet apart, and they should be sloped upwards for the reason I have just stated. The inner wall may be of brick, either 4½ or 9 inches thick, according to the height of the building, and it should be tied into the outer wall by pieces of thick iron wire with angled ends. The system of building with concrete blocks pursued in Sandown, Ventnor, and other places in the Isle of Wight, is well adapted for constructing walls on the principle I have indicated. The blocks of concrete are about 18in. wide by 12in. high, and are of two thicknesses; those for the outer wall being 4 or 5 inches, and for the inner about 3 or 3½ inches in thickness, and these are tied together by pieces of iron wire, with a space of about 3 inches between them. This forms what looks, to those accustomed to the 2-feet thick solid walls of Scottish houses, a very flimsy wall, but it appears to be sufficiently strong for a building of two stories in height; and with a few openings above and below for the admission of air into the space between the outer and inner walls, it would form a structure which, in a sanitary point of view, would be perfect, although I would prefer to have the inner wall of brick, which is more porous than the blocks of concrete, formed of fine gravel and cement, which are used in the Isle of Wight.

It is a common observation that, in spite of every care being taken in the construction of a building, the joints of the stone are often imperfect and admit water freely, especially when the rain is accompanied, as it often is, by high wind, especially when the wind comes from the south-west. To prevent the rain penetrating it is customary in some districts to build, not on a flat bed, but one sloping slightly upwards. This is a system highly to be commended; and if it be objected to on the ground of giving less stability to the building than working upon a per-

fectly level bed, this objection might be overcome by making the greater part of the bed level, with about two inches of the stone on the exterior side of the wall slightly bevelled.

In the case of rubble walls the best that can be done, probably, is to point them with a mixture of Portland Cement with twice its bulk of sand, taking care that the sand is not too fine; and then to whitewash the entire walls with Portland Cement, a process which may be repeated with advantage. But the pointing should not be done until the walls have had a summer's sun and are practically dry; otherwise the greater part of the water in the walls will evaporate inwards, that is, into the house, and so keep the atmosphere damp for a longer time than is actually necessary, A two feet wall will not dry thoroughly, however, even under the most favourable circumstances, in less than two years.

As regards the interior of houses, plaster, whether on brick or lath, is exceedingly porous, and permits of a ready diffusion of gases; and a wall merely whitewashed or coloured with distemper is better in a sanitary point of view than one that is covered with oil paint, which becomes by this process practically impervious to the passage of gases. Wall papers are probably not so bad in this respect as oil paint, but are certainly inferior to distemper or whitewash.

The foundation of a house and the basement are the most important parts of it as regards its sanitary condition. The most perfect foundation upon which a house can be built is a solid platform of concrete, extending over the entire area of the building, and from 2 to 6 feet in thickness, according to the height of the walls, and coated over on the top with nearly pure cement. No damp could penetrate this mass; but I would not, even in this case, lay the sleeper joists upon the concrete, but would place them at a sufficient height to obtain ventilation of the space below the floor. In case of accident, arising from the bursting of water-pipes, or other causes, I would make the concrete with a slight upward slope towards the centre of the area, so that water could run away freely through the ventilating gratings. This would be a somewhat expensive foundation, but I think it would be a most satisfactory one. Another system, which would probably prove equally good, is to build the foundation walls and dwarf walls up to a certain level, fill in the interior spaces with broken material *to the same level*, and cover the whole surface with a layer of Portland cement with two parts coarse sand 3 inches thick. Another system still is to place a damp course of slate, or slatey stone, bedded in Portland cement, on the whole of the walls; fill up the whole foundation to the same level with broken material, and

cover this, but not the walls, with asphalte. This makes an excellent foundation, but the filling in is generally omitted, the architect being content with a damp course on the walls just below the sleeper joists, and levelling the interior space and asphalting. In this way I have seen very serions evil resulting from the absorption of water from the soil by the portion of the walls below the damp course, this giving off sufficient watery vapour to keep the space below the floor quite damp and to introduce dry-rot to a most alarming extent. It is a not uncommon practice to neglect the precaution of putting a damp course on dwarf walls, in which case dry-rot is almost certain to occur unless there is profuse ventilation. In such a case the joists should be laid not in a wall-plate of wood, but upon roofing slates placed below each joist, but it is better to place along the top of the dwarf walls a complete anti-damp course of roofing slates or Caithness pavement bedded in cement, and upon this to lay a wall plate in the usual manner.

With regard to the ventilation of the space below the basement floor, it is a safe rule to have gratings all round the building, if it be a detached house, not more than 10 feet apart; but if it be in a street where ventilation can be obtained only in front and back the gratings should be not more than 5 or 6 feet apart, and should be of ample size, say 10 inches by 6. In order to facilitate the free circulation of air the dwarf walls and partition walls should have numerous and large openings. It may be objected to that such thorough ventilation as I have indicated would make a cold basement storey; but the simple remedy is to put ashes, with or without lime, below the floor, in the same way that deafening is applied to the upper floors.

In a wet climate such as ours, in which it is a not uncommon occurrence to have half an inch of rain falling in a single day, it is a proper thing to cover the chimney-tops in order to prevent rain from coming down and keeping the gable walls to some extent constantly damp; and it is a good thing to combine with the cover a means of preventing down-draught in the chimneys during high winds. The cover which I recommend is one having a flat top with a section of a cone below, the whole chimney top and cover being constructed of galvanized iron. The chimney is 10 inches diameter at the bottom and 8 inches at the top, the cover is 12 inches diameter, and the space between the top of the chimney and the cover is 4 inches. The cover is supported on three iron rods, and is fixed by nuts in the top, which are easily removed when the chimney is to be swept. All chimneys should be lined with fire-brick cylinders very carefully jointed, other-

wise a great deal of watery vapour from the combustion of the coal will find its way into the gablewalls, and there may be trouble also from smoke. A chimney from a gas stove, unless kept open below, is certain to give trouble from the condensation of water. Every cubic foot of coal gas gives by conbustion about an ounce of water, and as gas stoves consume from 10 to 30 cubic feet per hour, a very large quantity of water is produced. In ordinary coal fires the large proportion of heat wasted up the chimney prevents any considerable condensation of water unless when a fire is just lighted; but in the case of gas-stoves the heat passing up the chimney is comparatively small, and is probably never sufficient to prevent entirely the condensation of water.

In this brief sketch I have taken up only one branch of my subject, and I do not propose to deal with others, such as the ventilation of dwelling-houses and public buildings; but I shall merely notice, in conclusion, an exceedingly simple means of ventilating apartments, which I have found to give excellent results. It is to put in every window in a house a series of perpendicular holes, one inch in diameter, in the lower frame of the top sash of the windows. The holes may vary in number from three to six, according to the breadth of the window, and I may say that I have not found it necessary, even during the prevalence of the highest wind, or during the coldest weather, to close any of these orifices.

I fear I owe a humble apology to the architects who are members of this Congress for going beyond my own profession and invading theirs, but I trust that my remarks may be accepted in the same spirit in which they have been given. I have endeavoured to put together a few hints founded on my own observation and experience; and if some of my ideas are not new, as I can well believe, they may not be the worse for being enforced by repetition.

[*This discussion applies also to a paper by* JOHN HONEYMAN, *see page* 204.]

Dr. SIMPSON, Aberdeen, said that Mr. Honeyman's paper struck at the very root of the principles of sanitary science, as he would have them to build houses seven storeys in height in streets which were only 20 feet wide. Now this was just going back to the old evil which it was thought they had experienced quite enough of. But happily Dr. Wallace's paper had given a very effective answer to Mr. Honeyman when he showed that for a large part of

the year the houses in the lower parts did not get the benefit of the sun's rays. Light was one of the most important principles of life, and nothing was more depressing than the want of it. If you wished to quiet a lunatic or anyone in an excited condition, the best thing to do was to put him in a dark place, and he would soon be quiet enough. Then Mr. Honeyman appeared not to have understood the principle of ventilation. The air entering by the door of a room and by the window did not go straight up the chimney; but it had been shown by experiments that it went towards the chimney, got warmed, and then went up to the ceiling, so that a high ceiling practically got rid of those draughts which Mr. Honeyman complained of. Then there was the other consideration, that it would be an overcrowding of the houses. We might certainly object to have a narrow room, but to have house upon house would only mean overcrowding, which was one of those things that raised the death-rate more than any other cause. When there were many people together, the cleansing and the removal of refuse would be very difficult. The houses would also be badly lighted. In a word, he did not think that any saving in the matter of building would compensate for the increased density of population.

Professor JAMES THOMSON, Glasgow, said the papers of Mr. Honeyman and Dr. Wallace dealt with many subjects of great interest, but still they left room for much discussion and for differences of opinion on various points, especially on account of the wide range of details introduced in the paper of Dr. Wallace. Within the time allowed for remarks it would not be possible to enter on more than a very small part of the subjects opened up for discussion. Mr. Honeyman had it as an aim to give more floor accommodation by reducing the height of the ceilings, and thus getting a larger number of people to live in a limited space in large towns. When by dire necessity a great many people must needs be packed closely together on a small space of ground, it became desirable to devise, in such directions as Mr. Honeyman was recommending, means for producing the greatest amount of comfort attainable with moderate cost on that small space. Personally he (Prof. Thomson) would advocate to the very utmost that political economists and the corporations of towns should aim above all things at avoiding and preventing overcrowding, and at creating as many open spaces as possible. Any one could see while walking along the streets of Glasgow that the children of the working classes had very generally no place where they could go to play but on the pavements. It might be urged, that, however desirable it might be to have open spaces for playgrounds, yet on account of the cost it was difficult to get them: still the idea was not such a hopeless one as many people supposed it to be. Mr. Honeyman's recommendations were, he thought, worthy of much consideration in reference to the development of arrangements for making the most of small spaces. It was certainly unwise to insist on necessarily having a high ceiling, if, in other respects, the arrangements were to be such as to leave a great portion of the cubic space in the upper part

of the room to serve only for accumulation of vitiated hot air, while allowing the air for ventilation to flow mostly along the floor to the fire-place, cooling the feet of the occupants, without serving for their breathing. The recommendation, which Mr. Honeyman urged, to scour out the vitiated air from the ceiling was, he considered, very important.

Mr. E. C. ROBINS, London, said it seemed to be a paradox to have low ceilings and well ventilated rooms, but it all depended upon how they were ventilated. Overcrowding had been proved to be unhealthy, but it was still possible to crowd healthy houses together, such as had been done in the case of the artisans' model dwellings, and preserve a low death-rate. He criticised adversely the manner in which Mr. Honeyman proposed to provide for ventilation, and suggested that in such houses fresh air might be introduced at the back of the fireplace and heated before it was allowed to pass through the rooms. He illustrated on the black board in a very happy manner the defectiveness of the ventilating system proposed by Mr. Honeyman in his paper, as he understood him, and showed what he imagined would be a better mode of ventilating ordinary dwelling-houses. According to Mr. Robins plan, a draught would be made to come from the back of the fireplace, and passing behind the fire would get free over the mantelpiece with a vertical current, and afterwards circulate all round the room and back to the fireplace. Such a draught would provide the room with a supply of fresh air which would be cold in summer and warm in winter. Adverting to the construction of houses, he said that he had given up basement floors that are pervious. He made them of impervious materials, and covered them with wood-block floors.

Dr. J. F. SUTHERLAND, Glasgow, remarked that Mr. Honeyman's paper was, in his opinion, quite opposed to sanitary science. At the conclusion of his paper, Mr. Honeyman made the remarkable statement that within the last few weeks he had seen in a street 20 feet wide an admirable tenement of artisans' dwellings seven storeys high. Taking a storey to be 8 feet high, a building seven storeys high would mean a wall of 56 feet, with inhabitants from basement to roof. He presumed there would be houses on each side of the street, which would simply mean that the inhabitants of these admirable tenements would be deprived of sunlight during the best and greater part of the day. It could not be otherwise, as no matter what the disposition of the street might be there would be overshadowing. He did not know on what principal Mr. Honeyman based his argument, but he hoped the association would not allow it to go to the public that they encouraged such tenements, for it had been clearly shown that in houses deprived of sunlight there was a speedy deterioration of the human race. It had been shown by an eminent medical man that children deprived of sunlight soon developed scrofulous diseases, and more especially that form of scrofula known as affection of the spine. Mr. Honeyman had spoken

somewhat slightingly of the Glasgow Corporation, who would most effectually by their new Police Bill put a stop to such a building being erected as one of 56 feet high in a street 20 feet wide. Then Mr. Honeyman said builders were hampered by Parliament. All he had got to say was that if the attention of Parliament is not directed to this admirable tenement, wherever it existed, the sooner it was so the better. Rather than dislike such restrictions as he spoke of, they should have more of them, because such tenements as he described should not be allowed to exist.

Mr. G. W. MUIR, Glasgow, said Mr. Honeyman's courage in the city was well known. To the position that he took up some three years ago in regard to opposing the Corporation plans of the new municipal buildings they were indebted for the great improvement in the arrangement and style of those buildings, and he considered that for that act alone the citizens of Glasgow owed him a deep debt of gratitude. His own experience was that the healthiest room he ever lived in was one of a height of 7 feet 3 inches. He could touch the ceiling of it with his hands. He had a much greater floorage in that room than if he had a ceiling of 14 feet 6 inches. He was not surprised at so many gentlemen coming from London and crying out against narrow streets. He knew London pretty well, and he did not think there were above two or three broad streets in it. Look at some of the streets radiating from Cheapside. They were not more than 12 feet wide, and had walls of 50 feet high at least. Although sunlight was a good thing, it was not the only good thing, and he did not know any street where the sun would not shine some time in the course of the day. He believed that in Continental countries narrow streets were devised specially for the purpose of keeping the sun out and procuring a cool house. In the arrangements made by the police authorities of Glasgow and contemplated by them in the bill which they had prepared some time ago, but which was withdrawn from Parliament, the regulations were unnecessarily oppressive upon builders, would cause an enormous addition to the cost of houses, and thereby tax the working classes to an unwarrantable extent. These regulations insisting upon a certain width of street, and for a certain height of house, he had always opposed, for he did not consider that they were consistent with the best means of promoting the health of the population. A house of seven storeys in a street 20ft. wide might be a much more healthy house then a one storeyed cottage in the same street. Mr. Honeyman had shown, notwithstanding the contradiction of Dr. Simpson, that crowding, but not overcrowding, was quite consistent with the maintenance of health, provided attention be paid to cleanliness and ventilation. He was glad to find that so far Mr. Honeyman justified the remarks he (Mr. Muir) made on the preceding day respecting the intelligence of the officials of the Corporation of Glasgow.

Mr. HONEYMAN, Glasgow, said, he could only partially reply to the remarks made on his paper. There seemed to be a good deal of misapprehension regarding what he aimed at. His object in bringing up

the subject was that it might be the means of preventing overcrowding, which to a great extent was due to the raising of rents. Nothing more certainly led to the kind of overcrowding which resulted in a high death-rate than high rents. During the depression in trade which followed the City Bank disaster, many people could not keep houses for themselves, and went to stay with relatives, but they again took houses when trade got better and enabled them to do so. If the people could be healthfully housed in high tenements larger spaces might be obtained. Instead of a dingy range of houses, with a meuse lane running up between them, he would build say three blocks on the space, and leave large spaces between them. As to the tenement that had been referred to, it was in Gray's Inn Road, London. He had never seen anything better in the way of dwellings, as the houses were perfectly cleanly, bright, and airy in every respect. As to ventilation, he did not advocate the use of a ventilator at all. He would cut with a bevel a little bit off the top of the door, which the people would know nothing about. If a ventilator was put in the people would be sure to close it up. He had made some experiments, with the following results:—

NOTE.—Experiments illustrative of the foregoing, made with two models precisely alike in all respects except height.

1st. Smoke admitted over the doors in the low model (representing a room 7 feet high) passed rapidly over the ceiling, and in a few minutes was diffused through every part of the room. In the high model (representing a room 12 feet high) it passed across the room horizontally, diffusing itself through the lower part only, and leaving the upper part quite clear.

2nd. With ordinary inlets, in half an hour the temperature at the floor, in both rooms, was 65°, but at the ceiling of the high room it was 88°, and at the ceiling of the low room only 73°.

3rd. With special inlets (equivalent to 14 inches by 9 inches), close to the ceiling, in the low room on the floor the heat was 74°, and at the ceiling 72°; while in the high room, under the very same favourable conditions as to inlet, the heat at the floor was 77°, and at the ceiling 86°, showing a considerable amount of stagnation from which apparently the low room was entirely free.

4th. To show how completely the benefit of ventilation may be missed by want of distribution, the ordinary inlets were closed, and an inlet having the same area as the chimney was opened near the floor, on the opposite side of the room from the fire-place. A stream of cold air (equivalent to 5000 cubic feet per hour at least) passed diagonally through the room for half an hour, when the thermometer on the floor showed a temperature of 84°, and that at the ceiling 93°. In this case the stream of fresh air was in fact *absolutely of no use to the occupants of the room*; the atmosphere was not appreciably affected except within the very narrow limits of the area actually occupied by the current between the opening and the fire-place. Compare this with No. 3 experiment in the low room, where the *same quantity* of air was admitted.

It will be noticed that with the inlets at the ceiling the air near the floor in the low room was rather warmer than at the ceiling; but in the high room it was 9° warmer at the ceiling than at the floor.

Professor T. ROGER SMITH, the President, said they were greatly indebted to the readers of these two papers, and moved a vote of thanks to them. He had to do with the administering of an Act of Parliament while acting as a district surveyor in London, and it struck him as the result of experience so acquired, that the less restrictive any legislation could be made the more likely were the Acts to

be of service. They were beset with very great difficulties in dealing with the problem as how to house to the best advantage the poor in large cities. One would like to see them in the best possible dwellings, but these cost a great deal of money. They were compelled to provide a dwelling within the reach of the wages which the people could earn, and Mr. Honeyman was evidently aiming at that object.

On "The Testing of Drain and other Pipes connected with Dwellings, together with the Sanitary Condition of the Walls and adjacent sub-soil as affecting the healthy condition of Houses," by JAMES STEWART, Sen.

FOR a number of years past, the inhabitants of this city have displayed a very considerable interest in the efficiency of the sanitary appliances connected with their houses, and have shown a most laudable anxiety as to the proper testing of the various drains and pipes, which are the necessary constituents of every dwelling-house.

Having had for upwards of thirty years very considerable experience in the almost innumerable details of such matters as generally practised, and more especially as practised in the West of Scotland, I have some confidence in hoping that the notes of a successful practise and experience I am about to lay before you may have some claim upon your attention.

When a necessity arises for an examination of the sanitary condition of a dwelling-house, a Sanitary Engineer, or other duly qualified person is called in by the owner and requested to test the drains, &c. Unfortunately, however, these tests frequently extend no further than the house drains and vertical pipes. Then follows a report that certain defects exist in the drains and plumbing works, and such are recommended to be remedied and improved.

The drains are then lifted and relaid, or it may be, as I have frequently seen, that the joints or junctions are only cemented as they lie. The work is done: but no attention is given to the swampy and malarious condition of the ground in the vicinity of the defects which still remains in the same saturated state, due to the previous defects in the drains; or it may be from the still defective drains of adjoining houses, the level of which may be higher; or perhaps from ground water.

The drains being finished; the saturated material is put back into the hole or trench, the floor is closed up, and if any thought is given to the condition of the sub-soil, it is, that it will soon dry up, now that drains are supposed to be perfect.

The methods adopted for testing the horizontal drains and vertical pipes are as follows, viz. :—

1st.—By the *smoke test*, relying upon *sight* and *smell.*

2nd.—By the *paraffin*, *peppermint*, or other tests, relying upon *smell.*

3rd.—By the *water* test, which also relies upon observation.

Regarding the test by smoke it may be considered very suitable, indeed, perhaps it is the best for testing vertical pipes and apparatus in a house; as any defect usually becomes visible at once by the smoke, or is apparent, more especially if the wood work covering the pipes is removed as far as possible; otherwise a current of air may carry the escaping smoke up the recess for the pipes, which generally extends from the basement floor to the roof.

As regards the testing of drains, I cannot speak quite so favourably in applying smoke to them: assuming that the drains are defective, there are many houses of which the basement or ground floors are covered with asphalte, Portland cement, tile or other impervious flooring, so that it is impossible for smoke to find its way through, except at some small opening at the foot of the soil, or other pipes passing into the ground.

Again, a considerable part of the subsoil of this city and neighbourhood is composed of stiff clay; and it is the practice of builders to dig out trenches in this clay for the foundations of houses, deeper than the ordinary level of the cutting; the foundations are placed in this trench, and if the house is one of a street or terrace, the drains must go through the houses.

A square trench is usually made for the drains, which cuts through, or crosses the foundation trenches on much the same level, the consequence is that any leakage or sewage from the drains, runs along these trenches and so saturates the walls.

A case of this discription has come under my care where the water from a soil pipe flowed twenty feet along the foundation of the back wall, then turned inwards and along between two gables for thirty-five feet, and came out below the floor of the front room of the next house, which was on a level of between two and three feet lower.

In the filling in of the trench, the clay or stiff soil is thrown in upon the top of the pipes, and falls partly down the sides; but on account of the narrowness of the trench, the bottom part cannot be properly filled; then the whole is rammed level with the surface of the ground, and you can infer that

from the stiffness of the clay, with careless filling, a space is left along the bottom on each side of the pipe. When the house comes to be occupied, the sewage escapes into this space from the bad joints and junctions, the result being that the foundations are sapped, which I think explains why the partitions and walls of so many houses are cracked.

To return however to the testing, I have often found it difficult on account of the formation and filling in of the drains as above described to obtain the results I expected, being convinced in my own mind that the drain was really defective, but, between the clay covering the top of the drain, and the impervious formation of the floor, no smoke could be seen.

To overcome this drawback, I adopted the plan of probing the ground with an iron rod, pointed at one end, provided with a cross handle at the top. Some care and skill, however, is necessary to fix upon the suitable place, so as to use it to proper advantage. I have used this probe with the best results, viz., to ascertain actually that the smoke was really escaping from the drains, and to satisfy myself as to the state of the ground surrounding the pipes; the point of the probe indicating the state of the soil at the bottom of the trench.

I may mention other instances in which the full effect of tests by smoke may not be attainable, however bad may be the state of the drains. The junction of the house drain with the main sewer not being air tight, the existence of rat runs in the ground, or the presence of porous rubbish under the floors, all interfere most seriously with the efficiency of the test. Again, take the case of a new or unoccupied house in Winter, the temperature of the air contained in it is lower than that of the air in the sewer, consequently a current of air exists flowing from the house into the sewer and carrying the smoke with it.

There is also another instance of very frequent, if not constant occurrence, where the escape or appearance of smoke cannot be observed, which is, that although the upper parts of the joints are filled with clay or cement, small parts at the bottom are left quite open; this may arise through the carelessness of the workman, or may be left open with the idea of draining the ground; but the reverse takes place, the open part of the joint is therefore constantly sealed with water, and no smoke can escape.

As to tests with the smoke machine, attention should be given to the length and capacity of the main drain and its branches, the soil, and other vertical pipes; that is, if it is a large house, with a 9 inch main drain, and branches, with a high soil pipe, rain water pipes, &c. (as many of our best houses

have). I am of opinion that the miniature smoke machine some tradesmen use is quite inadequate to produce the desired result of a satisfactory test, as such a machine cannot have power to maintain a sufficient supply of smoke necessary to test the drains and pipes of a large house.

I have frequently heard it remarked that the smoke test is too severe. If the pressure was as great as some people suppose, we might expect to see the smoke blown through the sealing water in the trap; such an occurrence, so far as my knowledge extends, I have not seen: all that can be observed is a slight movement of the water at one or other of the traps when the machine is in action.

We will now consider the second method of testing, viz., the paraffin or peppermint test; but as I have entered so fully into the smoke test it is not necessary I should detain you with any lengthened observations on this method of paraffin, &c., &c., as they are so far similar in composition and action, viz., air with smoke, or air with the smell of paraffin or peppermint.

My remarks will therefore apply as to whether it can supersede the smoke test and give better results; from my experience I am inclined to give smoke the preference, from the statement already made as to the uncertainty of the smoke test when applied under certain conditions to the horizontal drains in the ground; the same will apply with greater force against the paraffin or peppermint test, both of which I consider to be trifling, uncertain, and misleading, if either of these are alone to be depended upon.

Nevertheless, in answer to this, it will be remarked by some, "that paraffin discovered the defects in my drains;" but I am quite as certain that many more will afterwards find out by other means the serious deficiencies that the paraffin did not discover. I could dwell longer on this point of the subject, were it not that time is limited; therefore I will now pass on to the third method of testing, viz.: "*The Water Test.*"

I have pointed out the injurious effects of the escape of sewage; but the injury resulting from the constant outflow of moist sewer air into and saturating the ground under the floors is a serious evil; it is therefore indispensable that the drains should be both *air and water tight.*

The application of the water test to the main drain of a house is, in my opinion, by far the best method, and is therefore superior to the other methods I have referred to, for is it not the fact that the object we endeavour to accomplish is to have the drains water tight.

This method is not generally practised, perhaps from the want of a suitable apparatus of easy and simple application, or

it may be from a desire to avoid the certainty of showing whatever defects of construction may exist. The *modus operandi* is this: the pipes should be entirely stopped up at the ends and filled with water, some upright part having been previously selected or formed for the purpose of observing if the drain holds the water, or the reverse; the other ends or branches having been closed in a similar or sufficient manner, the water may then be turned on, and the pipes filled to the part marked on the upright pipe, and carefully watched to see if the water falls below the mark; and should it do so it shows at once there is a leak somewhere, and no doubt can arise as to the actual results of this method of testing, and nothing is more certain or satisfactory.

Another advantage to be derived from the water test is, that the proprietor or tenant can have the satisfaction of observing the effects of it, either by showing the *efficient* or *deficient* construction of the drains at the upright part selected and marked for the purpose; this he could not follow out so well or readily with the smoke or paraffin tests; and in the event of a new drain being tested, the workman might be apt, on a defect being noticed, to fill it up hurriedly to hide it; such an attempt would at once be detected on the application of water.

In the majority of houses that I have been called upon to examine, I should not consider it at all requisite that any tests should be applied; as the damp appearance of the walls, and sometimes the floors, are sufficient of themselves to tell the true state of matters below.

The damp plaster is observed in some cases rotting above the parts that have been repaired with Portland cement, this repair having been done with the mistaken idea of keeping down the damp, or may have been done at the time of the last overhaul of the drains: such expectations are not realized; the insufficient relaying of the drains, or the neglect of draining the sub-soil is soon shown by the above-mentioned indication; and in addition by the paint at many places along the foot of the walls being destroyed, and getting daily worse, as the sub-soil gets more permeated.

Nothing else could be looked for, when at this overhaul of the drains, in addition to the very objectionable way of filling up the trench, no attention is given to the aëriation of the ground, and ventilation by air channels under the floor; and should the floors be formed of Portland cement, asphalte, Caithness stone, or tile laid upon a cement *bed:* as all of these are considered to be practically impervious, the damp is sucked up by the poweful action of the house fires, and is sure to find an outlet, which it does as I have stated through the walls.

Professor Pettenkofer and others in their researches on this important subject, have sufficiently demonstrated the permeability of air and damp through walls, and it may not be out of the way if I give one or two quotations from such authorities.

Professor Pettenkofer in his work, "The air in Relation to Clothing, Dwelling and Soil," states at pp. 80 and 81—"England has given proof how the public health can be improved, by keeping the soil clean through good drainage, abolition of cesspools, and abundant water supply." He also says, "This is my conviction, which I want to impress upon you, that the cleanliness of the soil, and diminution of organic processes in the ground of dwelling houses is most essential." Also, Colonel Geo. E. Waring, jun., the celebrated American engineer, in his work on the "Sanitary Condition of Dwelling-houses" (1877), at pp. 51 remarks:—

"We know very well from a difference in salubrity between houses standing on proper sites, and houses standing on improper sites, that this influence of the soil emanations is serious, probably, so far as the usual slighter malarial ailments are concerned, this soil influence is the most serious with which we have to contend. And at the same time the debilitating effect of the exhalations referred to—headache, neuralgia, loss of appetite, intermittent fever, &c.—take a far lighter hold upon the popular imagination than do often the fatal diseases which are produced by bad air of another sort. The low condition, and consequent susceptibility to infection, which the malaria of damp soil produces, doubtless aggravate very seriously the dangers arising from the other source, that is to say: persons enfeebled by exposure to malaria would often succumb to infection, when a robust person would withstand it."

The foregoing observations regarding the actual results of testing by the smoke machine have been altogether applicable to drain pipes; but the defects usually observed in the soil or other discharge pipes when applying the test to them, are insufficient water seal in the traps, open or cracked joints, and perforation of the lead traps or bends.

A great deal has been said and written on this popular subject. The cause of the destruction of the lead in this manner is by common consent attributed to the action of sewer gas; it may therefore be considered bold on my part to come forward and question a subject so universally admitted as this alleged action of sewer gas on lead pipes.

I have given this particular matter careful observation for a number of years, and the conclusion I have come to is, that the perforation is caused by the vapour or humid air in the drains

and vertical pipes, arising from the warm water discharged from the house. This vapour ascends till it comes to the trap, and there condenses in drops of distilled water on the upper side of the trap or bend. I have looked into a trap and observed the drops hanging, and have removed them with my fingers along with the destroyed part, as a substance which is chemically named "carbonate of lead;" and as each succeeding drop forms it falls off, taking a portion of this substance with it, and leaving a clean surface for fresh chemical attack.

At the time of the outbreak of typhoid fever at Crosshill in March and April, 1875, I was then acting as sanitary surveyor for the Govan Parochial Board in the district then known as "No man's Land;" and during my examination into the sanitary condition of the houses, I saw a good example of the action of vapour on lead, in the case of a lead-lined hot water cistern connected with a tenement there; this cistern had a wooden cover, and there was a space between the water and the underside of the cover, which was constantly filled with vapour, the action of which was seen in the coating of the leaden sides of the cistern with the substance I have referred to, a sample of which I have retained; and although I hold that the action on the lead pipes is by the vapour and not by sewer gas, still the same remedy would require to be carried out, viz., ample ventilation of the discharge pipes.

Dr. Alfred Carpenter, in his work, "Preventive Medicine and Public Health," states: "It is a soft and distilled water which acts so readily on lead."

Then Col. Waring, in his work formerly quoted, states at p. 33: "These gases (sewer gases) have in a much less degree, *if they have at all*, the power of decomposing lead pipes."

In my former remarks I have made reference to the re-draining of a house, the filling up of the trench with the same sewage-soaked soil. This practice, I may tell you, is going on every day in this locality, not only as regards the trench cut for the drains, but the whole water-logged area below the floors remains as it was prior to any alterations, attention not being given to the drainage of the ground water, neither at the time of the building of the house, or now, when a so-called improvement is made. This objectionable work that I have just referred to, is being executed by tradesmen who have neither the skill, experience, workmen, or sufficient appliances necessary for carrying out such work.

It is, therefore, all the more necessary that these matters should be attended to when we look at the position of many of the best houses in this city and neighbourhood, viz., the site of the house is excavated out of a sloping bank, leaving high

ground at the back, a raised roadway at the front; the back ground slopes to the house or back area, and consequently all the ground water, and perhaps the sewage water from a defective sewer in the lane behind, follows the slope of the ground, and permeates through the foundation. When this state of matters is combined with leaky house drains, you can readily understand what condition the house will be in; and though I merely state this as a hypothetical case, there are many houses in the surrounding locality in a similar condition, and where the configuration of the ground, although somewhat different, is equally telling against their sanitary condition.

In concluding these remarks, which I trust may have met with your approval, I have only to add that the neglect of the Sanitary arrangements which we find in so many habitations, calls for their regular and careful examination, and that our chief endeavour should be to rouse the interest of the general public in these matters, and I know of no other association, or organised body, that have done so much to promote this good work than the Sanitary Institute of Great Britain.

Mr. Rogers Field, M.Inst.C.E., said that he considered Mr. Stewart's paper on the testing of drains was a valuable one. The testing of drainage had an important bearing on the health of the community. Not only did tests such as those described by Mr. Stewart afford a reliable means of ascertaining hidden defects in existing drainage but what was even of greater importance such tests afforded a ready method of securing watertight construction of the drainage in new houses, It ought to be made imperative that all new drains should be actually tested before they are covered in. The general idea is that if drains are constructed of stoneware pipes with cement joints they must be all right. Nothing can be more delusive. No one except those who have had large experience in testing drains as ordinarily laid can have any idea how leaky they are. Even when the precaution has been taken of carefully examining the joints of the pipes before the drain is covered up it by no means follows that the drain is sound. The upper portion of the joints may be good, but underneath where they cannot be seen there may be defects. The only reliable way is actually to test the pipes with water in the way described by Mr. Stewart. If sanitary authorities were to insist on this being done, a wonderful improvement would be effected in the drainage of all new houses. This may perhaps be considered impracticable at present (though the speaker did not know why it should be) but surely it is not impracticable for architects always to specify that the drains should be tested. A stipulation of this kind is, however, at present quite the exception.

On "The Merits and Demerits of Various Kinds of Water-Closets in General Use," by DANIEL EMPTAGE.

It it generally admitted by all who have made "house drainage" a study, that the most carefully prepared scheme is frequently spoiled by an unwholesome W.C. apparatus fixed at its head.

It was experience of this nature which has induced me for some years past to pay particular attention to this subject, and by careful observations and experiments with various kinds of appliances, to endeavour, if possible, to find one which would work satisfactorily, and which might be rightly considered wholesome, and I have very great pleasure in laying before this Congress the information thus gained.

The "Bramah" pattern valve closet is the oldest form now in use, and although many improvements have been made in its construction, those in use to-day are the same in principle as the one which Bramah patented in 1778.

This closet works remarkably well, and has a capital appearance. The direct action drop of the water from the basin to the trap is also a good point, and the space between the seal of the trap and the valve being very small, very little foul air can accumulate or corrosion take place.

If this closet is properly fixed, flushed, and ventilated, and a reasonable amount of care exercised in its use, it will answer very well indeed.

Notwithstanding, however, the good character which it deservedly bears, it has disadvantages which preclude it from being considered the best one for general use, the following being some of its faults:—

1st. The liability of paper and other substances to become jambed between the valve and its seating, and thus allow the water to escape from the basin.

2nd. Its unsuitability for the discharge of slops, for which purpose all W.C.'s are at times used.

3rd. The liability of the overflow trap to become fouled, which not infrequently takes place in consequence of the W.C. being used as a urinal without being properly flushed.

4th. The valve-box, although small, is a container of bad air, and is to that extent objectionable.

These defects existed in Bramah's day, only perhaps in an

aggravated form, and it was to obviate similar evils that the notorious "old pan" closet was invented.

If we consider the number of valuable lives which have been sacrificed, and the amount of misery which has been caused by the escape of sewage-gas from W.C.'s and soil-pipes fixed inside of houses, it may well be doubted whether their introduction was really a benefit to mankind; but it is certain that the man who invented the "pan" closet let loose upon society an enemy which has done, is still doing, and will yet do, an incalculable amount of mischief.

It is, I think, without exception, the worst form known, and yet, strange to say, it has been the most popular, and is still used more than any other.

Thanks, however, to this Institute, and to the efforts made by our leading sanitarians, the public are now becoming aware of its treacherous character, and, as a consequence, its doom is fixed, and the time will come when it will be a thing of the past, to be seen only in our museums.

Seen from above, it has a very fair appearance; it is, however, only a "whited sepulchre;" its interior surface, which is equal to about 5 ft. superficial measurement, being generally covered by a mass of corruption. From this coating, undergoing decomposition, there constantly arises gases, as offensive, and perhaps as dangerous, as those which escape from an ordinary sewer or cesspool.

These gases, being held between the two seals, increase in virulence, until released by the tilting of the pan, when they belch forth, and who can tell the amount of mischief caused through persons inhaling these poisonous vapours early in the morning!

It is well known that a toilet pail, although constantly exposed to the air, soon becomes offensive unless frequently cleansed. Is it then at all to be wondered at that the interior of a "pan" closet, which becomes infinitely more filthy, and is entirely shut out from the air, should emit foul odours?

I have several times tried to mitigate this evil by ventilating the container, but only with very partial success.

There is but one remedy, viz., to take down the apparatus and burn it out. This, however, affords only temporary relief, for the moment it is again used the process of re-coating begins.

It is only fair, however, to say that there are, as usual, exceptions to this rule, for I have known "pan" closets which have appeared comparatively wholesome, but they have always been placed under very favourable conditions.

Besides the "valve" and "pan" closets, the only other kind in general use up to the year 1852, appears to have been the

old-fashioned straight hopper, which, owing to its shape and its bad flushing arrangements, was a most filthy apparatus quite unfit for the interior of a dwelling-house.

In the same year, Mr. George Jennings patented the "monkey" closet, now known in an improved form as the "wash-out."

The object of the inventor was to combine in one piece of earthenware a closet, offering some of the advantages of the valve closet, together with the simplicity of the hopper, without the disadvantages of either.

This closet, which was considered a great improvement upon the "Old Pan" and "Hopper" was at first much used, but it was soon found to be defective, as the excreta remained floating in the trap beneath, instead of passing through it at once to the drain, it therefore became very offensive, and although repeated attempts were made by the inventor to remedy the evil, he failed to do so, and in consequence ceased to recommend them.

During the past few years, other inventors have taken this closet in hand, and by the aid of improved flushing arrangements, have produced a better apparatus.

The advantage of the improved "Wash-out" is, that without the aid of a valve, a large surface of water is held in the basin to receive the excreta, which is effectually washed out into the trap beneath, from which it passes to the drain.

It has also the great advantage of being adapted for the discharge of slops.

It, however, still retains some of its old faults. The flow of water which washes out the basin loses much of its force before it reaches the seal of the trap, and is consequently not heavy enough to clear the trap with any degree of certainty.

Another objection is, that the shaft between the seal of the trap and the basin, which is mostly out of sight, becomes very foul, and emits offensive odours.

It was to remedy the sluggish action of the flush upon the trap that the plug valve closet was introduced in the year 1858. This apparatus has enjoyed a large share of public favour, one of its principal recommendations being the freeness with which the contents of the basin pass away out of sight when the plug is raised. It is certainly an improvement upon the discarded "monkey," but experience has shown that it does not come up to the requirements of a good wholesome closet. The contents of the basin, which glide away so easily, frequently do nothing more than force out from the trap beneath what was left from the last discharge, the present one remaining, to be, in like manner, disturbed by the next visitor. As a consequence, offensive odours are generated, which, passing up through the

hollow plug, cause much annoyance, and, perhaps, in some cases, danger. Again, the plug itself becomes, in a very short time, coated with filth, both inside and out, and emits a great stench, while the plug shaft quickly furs, and likewise smells badly.

For the discharge of slops this closet is very unsuitable. I have frequently seen the hollow plug completely choked from this kind of usage. In fact, so much mischief has been caused in this way that some manufacturers have found it necessary to issue printed instructions in reference to it.

To prevent gasses passing up through the hollow plug, trapped overflows have been introduced; but where slops are discharged, I cannot look upon this as a great improvement.

The inconvenience and annoyance caused by the chokage of traps beneath "plug" valve closets lead to the introduction of the so-called "trapless" closets. This is in my opinion a desperate remedy for the evil.

Given a properly trapped and ventilated drain, a soil-pipe thoroughly ventilated at head and foot, a short-arm from basin to soil-pipe, a basin always fully supplied with water, and a water-tight valve, and some kinds of "trapless," closets will act exceedingly well, leaving nothing to be desired.

Now it is very important that the fact should be borne in mind, that the advocates for these closets insist upon these conditions being carefully complied with, otherwise they do not recommend them.

By skilful workmanship, you may ensure the first four conditions, but no amount of skill can ensure the last two; and yet the temporary failure of either of these must result in the immediate admission of bad air to the house, its quality depending upon the state of the soil-pipe, while the state of the soil-pipe will depend upon the purpose for which the W.C. has been used.

If it has been used as a urinal, or slop-sink, the pipe must become very much fouled, and, consequently, the air drawn through will be very offensive.

Now I can understand the reason for wishing, if possible, to dispense with the trap from under a plug-valve closet, because of its liability to choke, and retain foul matters, but why the "Bramah" pattern valve should be fixed without a trap I cannot understand, as the direct action of its flush carries all clean out through the trap at once, if a round pipe trap be used, and, as this trap is ventilated direct from the top of the outgo, the air in the arm beyond is quite as pure, and probably more so, than with a trapless closet."

It will therefore readily be seen that to a round pipe trap

beneath a "Bramah," there can be no objection, while it has the great advantage of permanently shutting off all communication between the house and the soil-pipe.

To be rightly considered wholesome and adapted for general use, a closet should, in my opinion, possess the following qualifications :—

1st.—The water seal of its trap should be in sight, should stand up in the basin, and be quite safe from either momentum or siphonage.

2nd.—It should be so thoroughly flushed that at each discharge, every part of the basin and trap would be properly cleansed.

3rd.—It should be as well adapted for the discharge of slops as for a W.C.

A closet possessing these advantages is perfectly safe to use anywhere, and the only kind which, in my opinion, comes up to this standard, is that known as the "Direct action."

Within the last few years several inventors have turned their attention to the manufacture of this kind of closet, and there are now several in the market to choose from, each of which has some advantage peculiar to itself.

During the past four years I have tried several of these closets, by fixing them one at a time, for several months at my own house, and carefully watching their action; also at scores of houses where I have introduced them, and from the information thus gained, I find—

1st.—That these closets, when properly trapped, flushed, and ventilated, are perfectly safe and wholesome, and are free from the evils and annoyances attendant upon most other forms.

2nd.—That to ensure a thorough flush out, the water must fall with an avalanche-like action direct upon the surface of the water in the basin.

3rd.—That those basins which show an O. G. section are more readily flushed than those which have sides in the form of inclined planes.

4th.—That with a suitably shaped basin two gallons of water, delivered in five seconds, will thoroughly cleanse the closet.

5th.—That the ordinary round P or half S trap should never be used beneath these closets, because no reliance can be placed upon the safety of its seal.

6th.—Care is required in fixing these closets to ensure adequate ventilation to the trap, because, owing to the exposed position of its seal, it is liable, unless so guarded, to be destroyed at any moment by the discharge of a pail of slops; but if properly protected, it is quite safe from this action.

Where the position is such that this necessary protection can-

not be given, on no account should a "direct action" closet be used. It is better, under such circumstances, of the two evils to choose the least, and fix a good "Bramah" pattern valve closet and D trap.

One word with respect to closet seats. It is the prevailing fashion to have them to fit as closely as possible, and to keep the lid shut.

I think this is a mistake. If there are any gases to escape, they should be allowed to do so at once, rather than be kept boxed in, ready to belch forth into the face of the next visitor.

For this reason, I would discard lids altogether, and, provided a suitably finished apparatus could be introduced, the riser also, and allow the floor cloth to run right under the seat, leaving no space in the room where bad air could be detained.

Allow me, in conclusion, to say a word or two in answer to a question which is frequently asked, and which very naturally arises in the public mind, viz.:—

How is it that while the same state of things has existed for very many years, it is only comparatively recently that "sewage gas," "pan closets," and "D traps," have come to be considered such dreadfully mischievous things?

My answer to this is, that the arrangements of our houses with regard to health, are very much influenced by what the doctor says.

Now, it is a fact, that, up to a certain date, doctors, as a rule, did not recognize the evils of sewage gas, and, consequently, little attention was paid to it. It was a nuisance to be got rid of as much as possible, but W.C.'s and sinks were expected to be rather offensive, and the idea was seldom entertained that the annoyance could be avoided.

The illness of H.R.H. the Prince of Wales, in 1871, drew the attention of the medical profession very pointedly to the poisonous nature of sewage gas, and, at the same time, it aroused the public mind to the immense dangers of its deadly influence, and, as a result, the ranks of those eminent sanitarians, who had been long striving hard for sanitary reform, were soon swelled, and now, throughout the land, the medical profession—who financially have all to lose, and nothing to gain, except improvements in the general health—are coming forward, and doing their utmost in the cause of sanitation, and telling us that we might be more healthy if we would.

Mr. Rogers Field, M. Inst.C.E., quite agreed with Mr. Emptage, that the most carefully prepared scheme of drainage may be spoilt by an unwholesome w.c. apparatus fixed at its head. One of the greatest improvements in modern sanitary practice was the system of disconnecting the house drains from the public sewer by means of an open trap so as to make certain that no foul air from the sewer passed into the house pipes. But the success of this system depended to a great extent on a careful attention to the details of the internal house drainage. If these details were defective, so that foul matter was retained in any portion of the sanitary appliances disagreeable smells would be perceived at the open disconnecting trap, and very probably the system of disconnection would be condemned when the fault perhaps really lay in a single unwholesome closet. There was one point, however, in Mr. Emptage's paper with which he could not agree, viz., that under certain circumstances it was desirable to fix a so-called "D-trap." He considered this one of the worst forms of trap that was ever invented, as it always retained foul matter, and no amount of flushing would properly cleanse it. He had known instances of extremely bad smells from a disconnecting opening being found simply to arise from a filthy D trap, and entirely to cease directly the D trap was removed.

Mr. Collins thought that the D traps were an unmitigated evil, and as Dr. Jenner truly said, they were the double D's—disseminators and destructors. Mr. Emptage, however, had shown in the exhibition what system he preferred, but he would not enlarge upon that until he had heard the decision of the judges. He generally used Mr. Buchan's traps, and he always put one of his traps at the end of every soil pipe. He preferred to try and get an upward current of air continually advancing up the soil pipe, and ventilating the drain by a distinct disconnected chamber.

Mr. Emptage replied briefly, and said, that there was no man living more dead against the use of the D trap than himself, but at the same time he was bound to admit, that, without ventilation it held its seal more secure than any other form of trap in use for w.c. purposes; he said this after having made very many experiments with almost every form of trap known. He had, however never yet, himself, found it necessary to use it, and it would only be under circumstances such as he had named that he would allow of its being fixed.

"*The House that Jack Built*," *by* H. H. Collins, F.R.I.B.A.

In this paper, entitled "The House that Jack Built," Mr. Collins humoursly described the unscientific construction and the insanitary

condition of an imaginary residential villa built from the owner's own design.

THE PRESIDENT: We have had a very entertaining and somewhat instructive paper. I do not think that it leads to discussion in the same way as the other papers which we have considered and are to consider.

On "The Dwellings of the Middle Classes—The evils attaching to the present system of erecting middle-class houses, and the remedies which it is necessary to apply in order to secure their removal," by HENRY C. BURDETT, F.S.S.

THE Transactions of the Sanitary Institute contain more than one Paper of mine on the Dwellings of the Poor. Such dwellings are, alas, still very far from being what they should be. From an actual inspection of these dwellings in various parts of the country, I am compelled to declare with Mr. Fawcett that the first conditions of health, morality, and economy are alike impossible under the circumstances in which a large majority of the poor have to live. The house accommodation of the working classes in our large towns is often so bad as to make it impossible to overstate the evils arising from it; and I have often returned home, after a long day's inspection, possessed with a feeling of wonder that the poor, in the East-end of London, for instance, do not rebel in a body, and insist upon being better housed or knowing the reason why. Yet the evil is increasing; for it is revealed in the figures of the last Census that more and more people are crowding into the towns, and less and less are remaining in the rural districts. Thus, whereas in 1861 for every 100 people who resided in the rural districts, there were 165 people living in towns, in 1871 this number had increased to 184, and in 1881 it had reached 199, so it is accurate to say that to-day there are two people living in urban for every one residing in rural districts. This ratio is rapidly increasing, and the evils arising must therefore tend to increase rather than to diminish. Nor is Scotland, or even Glasgow, in a better condition than England in this matter, but rather the reverse. Some of you will perhaps remember that Mr. John Bright, in his Rectorial Address at Glasgow, said that 41 out of every hundred families in this city live in a single room, and beyond these 41, 37 more out of every 100 live in two rooms. This statement does not convey all the fearful consequences of such a condition of affairs, nor can anyone realize it unless or until they have made

themselves acquainted with the proportions and surroundings of such a room as that referred to by Mr. Bright. Many may well ask why, in the face of these appalling facts, do you not take the dwellings of the poor as the subject of your paper, rather than the dwellings of the middle classes? The answer is simple.

Attention has been directed to the former so frequently and forcibly that there is now every prospect of something effectual being done, though the remedy may entail parliamentary action and something like a social revolution. On the other hand, little has been attempted in the direction of middle-class dwellings, although investigation would prove that masses of the middle classes, though higher in the social scale than the working class, are frequently as badly provided with house accommodation as any class in the community. There is much that demands attention in the dwellings of the middle class, and especially in those of the lower middle classes. The wealthier classes are able to take care of themselves by the employment of such able architects as they may like to select, and the poorer classes—artizans and the like—have thousands of well-arranged and carefully-constructed dwellings erected for them from the designs and under the superintendence of the same class of architects. But the poorer middle classes have no such power or means of securing healthy dwellings for their own occupation. To prove this and to realize the crying nature of the evils attaching to the dwellings of the middle classes, it is necessary to pay a visit to a suburban district under the control of a Local Board, and to make an inspection of several houses in various stages of erection. These houses will be to let at from £35 to £50 to £75 a-year, and possibly at a higher rate still. They will be occupied by that hard-working class, bank clerks, commercial clerks, civil service clerks, and others, who have to present a decent appearance and to keep and bring up a young family on an income little, if at all, in excess of that earned by a skilled artizan or mechanic—say £3 to £5 per week. The occupier of these houses will often have a lodger or a parent to share the house and lessen the expenses, so that the four or five bed rooms are always fully occupied.

Such houses are erected by speculating builders, known as "jerry" builders, are usually mortgaged as the work proceeds, and have no one to look after their construction except the surveyor to the Local Board. He, poor man, often without an apology for assistance, cannot be in every part of his scattered district at the same time, even if he wished to supervise all this class of work efficiently. Besides, it too frequently happens that the jerry builder is himself a member of the Local

Board, or has powerful friends there; and in such cases the surveyor finds it inexpedient to interfere with certain houses which are consequently the worst of their class. In the model buildings' bye-laws, published under the authority of the Local Government Board, nearly every essential for a healthy properly constructed dwelling is provided for, but in many districts, even where the bye-laws are in use, they are practically a dead letter, owing to the unwillingness of the Sanitary authority to enforce them with uniform energy. Yet the power taken in such bye-laws, and which might be brought to bear upon the builders, would render jerry buildings an impossibility, if the Local Boards were determined to enforce such bye-laws without fear or favour. Every Local Board, that is, the large majority, does not so enforce the bye-laws, and is consequently in league with the jerry builder.

We are daily reminded of the power of combination amongst the working classes. Why do not the lower middle class combine in self-defence and crush their present oppressors the pot-house politician and his ally the jerry builder, who at present too often return and control the members of the local boards, and whose rule is a grinding tyranny accompanied by preventible disease and suffering, not infrequently resulting in premature death?

For the purposes of this paper the writer visited a suburban district, Willesden, where middle-class houses are growing like mushrooms, where the Local Board have really a good surveyor and a building inspector, and where houses have been and are being built by speculating builders, one of whom is a member of the Local Board. These houses offer many points of interest as being at variance with the bye-laws now in force in the district. The houses of these speculative builders are outwardly attractive and comfortable in appearance, and internally the rooms and arrangements are takingly planned. The reason is that directly they are roofed in, and often earlier, they are sold, but within two years they become a misery and a danger to the occupants. Why? Let us examine and inquire on the spot. The builder has several houses on hand in different stages of construction, so every portion of the work can be brought under observation. Here is a grass field, and on a clay soil a house is being commenced. The foundations are being put in; the turf has been removed from the surface of the ground, and a trench is being made, six inches deep and some eighteen inches, or the width of the footing of the house wall, wide. Into this trench they are putting concrete, *i.e.*, jerry builders' concrete, made of siftings of dry earth and a little lime. On the top of this concrete the walls of the house will be built, and the joists

or supports of the floor boards on the ground floor are consequently placed practically upon the clay soil, or within a few inches of it. If you come to this next house, which is further advanced, you will see that the damp course in the walls, to prevent the damp rising throughout the house, consists of tarred felt, a material which will be quite useless for its purpose in a few months time. It is cheap, however, and keeps out the damp long enough to enable the builder to sell the house. Now look at the mortar of which the house is built. It is even worse than the concrete, being made of rubbish, *i.e.*, of lime and burnt clay siftings, or in large part of clay pure and simple. By facing-up and pointing the brick-work this jerry work is effectually hidden. After a brief interval, however, the appearance this outwardly beautiful piece of brick-work will present, can be seen by looking at that house over there, where large cracks and bulging walls speak eloquently.

Here is a house, empty, which was completed and occupied two years ago. Notice how the inside is finished, to take the eye: good mantel-pieces, showy grates, and attractive papers. Now look at the floors. Not one of them is level; they are at all sorts of angles, owing to the sinking of the walls. You have to walk up and down hill, as it were, to cross each room in the house. Notice how the damp has risen, even to the second-floor rooms, and in all the water has come through the roof, not in one, but in many places. The bath room, &c., is conspicuous, but only to the practised eye, by reason of the scamped plumbing and forbidden fittings used. Look at the exterior. The footings of the chimneys are above the ground level, the garden walls are all bulging out, the piers cracking and coming to pieces; and, if left to themselves much longer, they will fall down. Observe how the roof sags, owing to the scantlings of the rafters being insufficient; and in case of fire, though a detached house, it is so close to the next, that the fire must spread because the usual protection against fires spreading from one house to the next is absent—no parapet being carried up on the external side walls. Built on clay, containing, practically, no cellars and no damp course, it is literally placed flat on the ground. Notice that the floor level of the house is now below the level of the garden: and on this fine summer's day the dampness is shown many feet up the walls of the house.

As to sanitary arrangements these houses over there have a cesspool in their front garden within 20 feet of the front door, which overflows through the front garden wall and under the foot path into the street gutter, as you will observe. Look at the soil pipes! One lead one there has no less than six angles, and is tapped at the top by a ½-inch pipe ventilator,

and one is carried up to the chimney and turned over at an acute angle into the chimney itself. In more than one instance the soil pipes are leaking on to or down the sides of the houses. See again, this house has had to be under-pinned within two years of its erection and since it was purchased from the builder.

Finally observe that as you walk through the district many of the houses are worse than those we have been examining, that the rentals vary from £35 to £75 per annum, that new roads occupied for two years present the appearance of sloughs of despond, because the Local Board declines to take them over, but that nearly every house is occupied, and that many are sold before completion.

Now observe what the bye-laws of the Willesden Local Board, with respect to new streets and buildings passed in 1881, provide. The whole ground surface or site of a house must be properly asphalted and covered with a layer of good cement concrete, rammed solid at least six inches thick. The building must be solidly put together (1) with good mortar, compounded of one part of good lime, and of three parts of clean sand or other suitable material, or (2) with good cement, or (3) with good cement mixed with clean sharp sand. Every wall shall have a proper damp course of sheet lead, asphalte or slates laid in cement, or other durable material impervious to moisture, beneath the level of the lowest timbers, and at a height of not less than six inches above the surface of the ground adjoining such wall. All footings shall rest upon some solid and sufficient substructure as a foundation, or not less than nine inches of good concrete. Every party wall shall be carried up at least nine inches in thickness, for a height of at least fifteen inches above the roof, flat, or gutter of the highest adjoining building. Every soil pipe shall be at least four inches in diameter, shall be outside the building, and be continued up without diminution of its diameter, and without any needless bend or angle being formed in such soil pipe. Every cesspool shall be at least fifty feet from a dwelling house, the brickwork shall be imbedded in cement, and shall be made watertight, with a backing of at least nine inches of well puddled clay around and beneath such brickwork.

Many other provisions might be quoted, but enough has been said to prove that in some cases, at any rate, if not throughout the district of Willesden, the builders set these regulations at defiance, and wholly and openly disregard them. This curious state of affairs is often due to the astuteness of the builder in becoming a member of the Local Board. In one suburb one of the most notorious offenders was, I am informed, once turned off the Board by the indignant ratepayers, but when a vacancy

occurred soon afterwards the Local Board sent a deputation to the builder in question and invited him to fill the vacancy thus caused, which he accordingly did. He secured the Board's approval of certain plans for the erection of a number of houses, before the model bye-laws were passed in 1881, and because of this he claims to be able and is still allowed to build without check or hindrance the class of houses we have inspected and examined together.

It must not be supposed, however, that in naming Willesden I do so because it is especially bad. Far from this being the case, I wish it to be understood that in some respects Willesden is far better managed than certain other localities. Indeed, I had intended to incorporate in this paper instances showing the condition of middle-class dwellings at Stamford Hill, Brixton, and elsewhere. There the jerry builder flourishes to an extent hardly credible; and if—as in an instance which came under my own notice—the individual occupant (a civil service clerk) of the jerry-built house tries, of his own strength, to obtain redress and a healthy dwelling, he is defied by the builder, aided ineffectually by the officers of the local authority, forced ultimately to attend the Police Court on five separate days, owing to continual adjournments, left for weeks with an open, foul-smelling drain in the middle of his kitchen floor, which causes general illness to the inmates of his house, and is finally forced by his despair to execute the necessary alterations at his own expense. Is not the condition of the occupant of a middle-class dwelling as much entitled to sympathy and succour as the class below him?

What, then, are the remedies?

First and foremost, that householders shall combine and form themselves into a Local Association, which shall defend them from the cruel wrongs they now have to endure. A very small subscription, probably 5s. a year, to such an organization, would suffice. The first step for such an Association to take, is to select and secure the election of suitable men on the Local Board. Then its funds could be utilized to prosecute offending builders, and to secure the detection of any breach of the bye-laws. In this way and by the exercise of a little public spirit on the part of the classes interested in these matters, an effectual stop would soon be put to the existing evils, and the jerry builders' lot would cease to be a happy one. Under such a system the local sanitary authorities, which now so often neglect their duties (statutory and implied) would commence a course of action which would possibly warrant their possessing greater powers.

Extended legislation on one or two points would then be

justifiable. No builder who was engaged in the erection of buildings within a district controlled by a local board, should be eligible as a member of such board. Bye-laws would be enacted as to the height of rooms, as to hearths (the hearth being part of a floor, cannot at present be dealt with by bye-laws), and as to the materials used to plaster the interior of houses, which is at present frequently kept in its place by successive coats of papering. All these latter items, and others of more or less importance, might be dealt with if the 157th Section of the Public Health Act of 1875 were amended by allowing sanitary authorities to make bye-laws "*with respect to new* buildings," and leave the Local Government Board, as the confirming body, to determine whether any proposed building regulations were reasonable or not. In this way every part of a new building could be dealt with as far as bye-laws can secure this end. The Local Government Board should possess full power of control, because they are answerable to the House of Commons and to the country, and if they are not well advised in any technical matters they can get more competent professional officers.

Local governing bodies should be liable to some sort of punishment if they are shown to fail seriously in their duties. As an instance of this, I may quote the district of Bangor, where last year the Local Board allowed, by gross neglect, their water supply to be poisoned by specific disease, and thereby caused a fearful epidemic (upwards of 550 cases and about fifty deaths), which, apart from the amount of personal misery and anxiety experienced by the relatives of those attacked, caused a money loss to the town which has been estimated at between £50,000 and £60,000. The splendid Penrhyn Arms Hotel there, was for many weeks, in the season, without a single visitor, and trade was almost at a standstill. Such a condition is surely one which ought to bring about some such punishment as corresponds with disfranchisement in corrupt boroughs. Instead of this, it has been decided to elevate the Local Board of Bangor to be a Corporation. Though the immediate effect of this is to bring in a lord as the first Mayor, it will ultimately result, no doubt, in the Corporation being composed of precisely the same class of men as formed the Local Board.

As regards the Acts now regulating building matters, there are in London the Metropolitan Buildings Act, 1855, but this Act, apart from certain regulations as to duties of adjoining owners, &c., deals almost exclusively with securing stability and the prevention of fires, health matters being, as may be implied from the date, almost entirely lost sight of. A recent Amendment Act, 1879, enables the Metropolitan Board of

Works to make bye-laws as to, amongst other matters, foundations and materials for walls. But these are not all important matters, and when it is borne in mind that the Metropolitan Board of Works has no medical adviser, and that the bye-laws it makes have to be confirmed, not by the Local Government Board but by the Home Secretary, who also has no medical department, is it surprising that sanitary matters do not form an important part of the Building Acts? In London the vestries, acting under the old Metropolis Local Management Act, 1855, have control over drains of houses, and this might be sufficient if it were effectually and uniformly applied through *competent* officers. But vestry surveyors are not ordinarily a very well-informed class of men, and as the Act merely says, everything is to be either "sufficient" or "to the satisfaction of the vestry," and does not prescribe definitely what is to be required, it is of little real use.

In the provinces, except where there is a local building Act, *i.e.*, where the authority is above being advised by the Local Government Board, and is rich enough to get special Parliamentary powers, they obtain bye-laws under the 157th section of the Public Health Act, 1875. These may be made by any urban authority and, with the consent of the Local Government Board, by any rural sanitary authority also. In the latter case it is usual for the bye-laws to be applied to certain *parts* of the rural sanitary district—parts which are not sufficiently populated to be formed into urban self-governed districts, but in which there is more than ordinary building going on or about to go on. It is, I think, matter for consideration whether the time has not already arrived for making most of the ordinary building regulations applicable by Act of Parliament to all new buildings wherever situated.

A house in the most rural district, miles away from any other house, ought to be built with strict regard for reasonable stability, for health, and for safety from fire. For an owner of a house, if he may burn his own property, ought not to be allowed to burn, or even to frighten his servants, his visitors, his assistants, or even his relations. Neither ought he to injure or kill them by an insecure or unwholesome building. The necessity for making efficient separation between houses to prevent the spread of fire was shown at Margate some time since.* A fire occurred in Cecil Square in that town where the Assembly Rooms took fire, which spread to a number of adjoining houses. The whole of the south side of the Square, including a ladies' school, was burnt out, and, although no one was killed, all

* *28th October*, 1882.

were terribly frightened and inconvenienced, and probably the business of several was more or less ruined.

At present urban authorities may, but are not obliged to make, building bye-laws; and if they make them, they need not enforce them. Rural authorities can get power to make building bye-laws, but often do not trouble to do so. Hence, in lots of places houses are being built under no local supervision whatever. Hastings and St. Leonards may be mentioned as instances of this. The urban district is, I believe, only about half-a-mile deep from the sea, and three or four miles long. This area has building regulations, but outside the urban district to the North, many new houses are, I believe, being built in the rural districts under no control at all other than that of the owners and builders concerned. At any rate, I am informed that the Hastings Board of Guardians, as the Rural Sanitary Authority, have no building bye-laws.

Such is permissive legislation, and at this time of the year when we send our children and families to the seaside to take in a stock of health and strength for the winter, we are often compelled, unwittingly no doubt, but none the less certainly, to house them where the most important principles of sanitation are neglected.

Such are some of the remedies needed and recommended. In considering them, and this question of the dwellings of the middle classes, we have necessarily been brought face to face with serious evils, which nearly affect ourselves. It is to be hoped, with the aid of the Press and the discussion which will, I hope, follow the reading of this paper, that an adequate and permanent remedy may be found and applied.

Mr. H. H. Collins, F.R.I.B.A., London, was of opinion that middle-class people were somewhat better protected than Mr. Burdett seemed to think. He admitted that there were a certain class of builders infesting the suburbs of the Metropolis, who had been called "jerry builders," and who built such houses as Mr. Burdett had graphically described. There were suburbs close to Willesden, in London, where Mr. Burdett's assertions would be, to say the least of it, rather exaggerated. Speaking from his own practice, it was not very long ago since he was instructed by a firm of solicitors, to act on behalf of a builder because the Acton Local Board had positively condemned a whole row of houses which had been built in contravention of their bye-laws. They were properties erected for business purposes—large shops, &c., at a cost of from £8,000 to £10,000. He

was sent to try and get a remission of the sentence upon the builders, who had been ordered by the local board to take them down. Mr. Burdett, therefore, made too sweeping an assertion in saying that none of the local boards did their duty. Anyone who perused the newspapers would see the way that his colleague, the district surveyor, who had the fortune and misfortune to look after the district of Hammersmith, acted from time to time against those who were using bad bricks and not covering the site with concrete, as was required by the rules laid down by the Metropolitan Board of Works. Again, the middle classes had a remedy in their own hands. It had been laid down by the highest legal authorities that all a man had to do was to ask the agent or owner of the house whether it was in a proper sanitary condition, and if the answer was that it was so, that amounted to a guarantee; and if it were found that the house was not in proper condition, the tenant could obtain redress by law. If a man could afford to take a house at £50 rent, he could also afford to have it examined for a very trivial sum.

Professor ROBINSON said it was true that the occupier of a house which was in an insanitary condition had a legal remedy, but surely the great point was to prevent such a necessity. What the author of the paper had said regarding dwellings in London was borne out by his own knowledge of that city. It was within his knowledge also that there were numbers of excellent local surveyors to vestries and other authorities, who were as keenly alive to their duties as any person could possibly be, but to these the observations of the author of the paper did not apply. When they were dealing as they had been that morning with the means of removing sources of evil and death, it would be a monstrous thing were they to see, without notice, houses springing up which failed to comply with the most simple requirements of sanitary knowledge. Surely it was too late when an epidemic broke out and some member of the family died, to then seek redress, and the efforts of the Institute should be in the direction of preventing such a necessity. If he had had the time he could, within his own personal experience of London, occupy the whole afternoon in illustration of cases in that city as well as in many others. He could support what Mr. Burdett had said in every particular, and he thought every one would agree with him that a determined effort should be made to raise public opinion against the abominable condition of things, and have the local boards prevented from permitting these jerry builders to put up such houses.

Dr. CARPENTER said there was no doubt whatever—he knew it from personal experience, acquired from observation upon those who had suffered from the consequences—that the matters that were detailed by Mr. Burdett were true to the letter. The town of Bangor had been referred to in the paper, we may recollect that that town had been severely punished for its neglect to obey sanitary law by the epidemic which had visited it. He believed that the evils dealt with in the paper would be best removed were every man called upon to

do his duty as a citizen in connection with his parochial position. He knew that in the south when individuals were proposed for election to Local Boards and Town Councils the majority of the respectable people living in these respectable houses did not go down to the poll to vote for the proper persons. There was no doubt that the intellect and intelligence of the country failed to do their duty in connection with the election of Sanitary Boards. It therefore appeared to him that the great principle that ought to be involved in a Congress like this was that they should call upon men to do their duty as citizens in this matter. To draw the attention of the public to the conditions that were necessary to be obeyed in connection with sanitary laws appeared to him to be of far more importance than to rush off to the Government saying—"You must do this and that." To tell people to do their own work and not ask Government to do it for them appeared to be the best plan.

Mr. Rogers Field, M.I.C.E., also supported Mr. Burdett in his statements, because they were not exaggerated in the slightest degree. There had been such an abominable system of building carried on in some of the suburbs of London that houses had been let to tenants who could not stay in them. Some of the drains of these houses were laid so badly that the fall was from the sewer towards the house, and in one case, in order to get a drain cleansed, it had been found necessary to dig a hole in the garden and draw the sewage from the sewer back towards the house. He agreed with Mr. Burdett that there ought to be fewer builders on Local Boards. The origin of the evil was that the builders exerted themselves to get on to the boards, and when there they did not seek to enforce the bye-laws, as it was against their interest to do so. Although these boards had power to make regulations they seldom did so, and thus no proper supervision was exercised over builders of new houses. He considered there should be a very great limitation, if not an absolute prohibition of builders being on these boards.

The President expressed his own indebtedness to the writer of the paper, and to those who had spoken on the subject. He thanked the author for his indirect corroboration of some of the things he (the President) had ventured to state in his opening address that morning. In fairness to the great many hard working men who were striving to do their duty in the face of great difficulties, he wished to be allowed to remind the Congress that London was a large place, and if some of the surveyors were not sufficiently supported by the local boards or parishes for which they were employed the majority of them were working hard, and doing their best, and but for their labours, things, he believed, would be a great deal worse than they were at present. These surveyors had a very onerous task to perform. It was hardly correct that the Board of Works in London had no sanitary advisers. They were advised by two gentlemen of acknowledged skill in regard to drainage.

Mr. Burdett said he could endorse all that the President had said

about the earnest way in which the local surveyors did their work. Nobody appreciated their labours more than he did. The paper was not directed against the local surveyors, but was to call the attention of the ratepayers to the fact that they ought to support the surveyors. He would not like it to go forth that they thought a legal remedy preferable to a healthy house. He hoped one of the results of that discussion would be that the press would emphasise the power invested in every citizen, so that there might arise some organization as he had foreshadowed, with the view of securing right ratepayers upon the Local Boards. If they wanted healthy homes, it was the duty of the citizens to follow the lines he had indicated. He had inspected the dwellings of the poor in most parts of London, in Dublin, and in the leading towns in the States and Canada, and he thought he might claim to know what constituted a healthy tenement. In writing the paper he had endeavoured to describe faithfully and without exaggeration what he saw. He had told them where he had seen the houses, and he had kept a list of the buildings he visited, and he would challenge anybody who doubted the literal accuracy of his descriptions to accompany him to the buildings and judge for himself.

On "The Scavenging of Towns," by JOHN YOUNG, Inspector of Cleansing, Glasgow.

SCAVENGING is not, generally speaking, a popular subject. It is, however, one of vital importance. It has unquestionably a most direct bearing upon the health and comfort of the inhabitants of towns and cities; and anything of which this can be said must have an interest to the Sanitary Institute of Great Britain.

I do not profess to have much that is new to say on the subject; but simply a few observations from my experience in Glasgow.

I shall first of all give a short sketch of the work of the cleansing department of this city as at present carried on by the magistrates and council. It may be well to premise that the present population of Glasgow, upon an area of 6034 acres, is estimated at 531,200; and the assessable value is £3,425,646. The general cleansing of the city, although under one management, is reckoned under three sections, viz., (1) Domestic Scavenging, or Night-soil and Refuse Removal; (2) Street

Scavenging; and (3) the Scavenging of Private Courts or Back Yards.

Reversing this order I shall take:—

I. THE SCAVENGING OF THE PRIVATE COURTS.—In this branch of the work we have 218 men, including foremen, employed daily. Their working hours are from 4 in the morning till 9, and from half-past 10 till half-past 3. The city is divided into six districts, and these into eighteen sub-divisions. The sub-divisions are again divided into beats, and each man has his own beat to scavenge. All the closes or entries and courts by or to which more than one tenant has right of access are swept, daily once, twice, or thrice, according to their requirements. Eighteen of the men are constantly employed scourging the dirtier courts and closes with hose, which they attach to the street fire-plugs. The staff also includes public urinal cleaners and ashpit limewashers. The total sum spent under this heading is, in round numbers, £10,000 a year. To meet the expenditure for Cleansing Private Streets and Courts, the Glasgow Police Act authorises the levying of an assessment not exceeding 1d. per £ upon all property bounding with or having right of access by or to any private street or court. I may mention here that all the scavenging under the two following heads is paid for out of the general Police Rates.

II. STREET SCAVENGING.—The total lineal measurement of streets and roads within the city boundary is 153 miles. In this section 175 men are employed, including foremen; and we have sixteen horse-drawn sweeping machines. The street scavengers are stationed under the same districts and sub-divisions, and work the same hours as the court scavengers. The horse-brushes are worked during the night, starting at eleven o'clock. For scavenging purposes we have first, second, third, and fourth-rate streets. All the first, or principal streets, are machine-swept every night, and the second and third less frequently, according to their requirements. The fourth-rate streets are, as a rule, those which are paved with rubble or undressed stones, and are swept by hand-brushes. The principal thoroughfares, which are swept every night by machines, are also picked, and the channels swept by hand-brushes during the day. Our latest improvement in this connection has been the introduction of a registered street-bin for the deposit of the droppings picked up from the principal streets. This bin is sunk flush with the foot pavement—the frame forming part of the kerb—so that it is no obstruction whatever. It is chiefly on this account that I consider them so much preferable to pillar-bins, such as are used in London. (Any gentleman interested in the subject may take notice of them in Buchanan Street or George Square.)

The amount we expend upon street scavenging and watering (exclusive of the removal and disposal of the scavenge) is, in round numbers, £12,000 a-year.

III. DOMESTIC REFUSE AND NIGHT-SOIL REMOVAL AND DISPOSAL.—(I may explain here that the carting and disposal of street scavenge is embraced in our accounts under this head.)

In this section of the work 240 men, including foremen, are employed, and a stud of 175 horses, with the usual relative plant, which in our case includes 600 railway waggons for carrying the city refuse to the country. On the average for the year 700 tons of manure and refuse are dealt with daily; and I may mention here that the cost of this section, deducting revenue from expenditure, is, in round numbers, £21,000 a-year.

In explaining our method of dealing with the city refuse, I shall first speak of its *collection* and afterwards of its *disposal*.

In regard to the collection, I may say that we have tried several modes by way of experiment, but the two systems which may be said to be in operation in Glasgow are the morning-cart or bell-cart system, and the ashbin or ashpit system. The former is in operation chiefly in the centre of the city, where the properties are principally occupied as shops and warehouses. As a rule fixed ashbins or ashpits have been abolished in the districts overtaken by the bell-cart. The great bulk of the domestic refuse of Glasgow, however, is collected from ashbins or ashpits. The most of these places of deposit are now small and improved in construction. As a general rule they are emptied once in eight days. In the denser parts of the city, however, many of them are emptied daily and others twice or thrice in the week, while in the less densely populated districts, especially where there are lanes running behind the properties, the intervals are much longer. The most part of the ashpit contents is removed by the staff working during the night between the hours of 11 p.m. and 9 a.m. Any portion removed during the day is taken from ashpits abutting with the lanes. As to the excrementitious matter, I may state that of late years water-closets have been largely adopted in dwelling-houses in all parts of the city, so much so that much the larger portion of the excrement is disposed of by water carriage. We have, however, 3,155 pail closets in use in connection with dwelling-houses, and 1,268 in connection with workshops, factories, &c. A large proportion of the pails are removed in covered vans on the exchange-pail system, and we are extending this system of removal as far as practicable. Then, to tell the whole truth, we have still a remnant of the old system of privy and ashpit combined, but these will soon be abolished, and the sooner the better, as, laying

aside the question of health, there is no means of emptying such middens without creating an intolerable nuisance.

The *disposal* of all the various classes of refuse collected in the city is the most serious task of the cleansing department. The natural destination of manurial refuse is of course the land, where it becomes the food of plants. Scotch farmers, as a rule, prefer bulk manure when it is available, to chemical manures; that being so, we endeavour to place our city manure within the reach of as many of them as possible. The result is that we supply city manure to 2,400 farmers whose holdings are situated over fourteen different counties. Until recent years our system of mixing and dispatching refuse was rather primitive. We have now, however, erected city refuse dispatch works at St. Rollox, in the northern district of the city, and other works of a similar kind are in course of erection on the south side of the river, good railway connection having been secured in each case. These works are thoroughly enclosed, and supplied with machinery and apparatus for dealing with the various kinds of refuse. The soil carts are taken to the upper floor where the fæces are emptied into air-tight cast-iron tanks. The ordinary refuse is also taken to the upper floor, whence it passes down through a double acting revolving screen. The finer ash passes, or is carried, into a mixing machine along with a mechanically regulated quantity of excreta. Some street sweepings, after being treated as I shall explain further on, are also simultaneously shot into the mixer, and thus a prepared manure—in a great measure deodorized and free from all hard rubbish—is passed mechanically into the railway waggons. The full waggons are at once dispatched to supply farmers' orders, or, failing them, to a yard 12 miles distant, where the manure is temporarily stored for the supply of future orders at such times as the daily supply falls short of the demand. Thus each day's collection is disposed of as it arrives, and the necessity for storing refuse within the city is got rid of. The cinders taken from the domestic refuse are more than enough for raising the necessary steam for the works. [I may mention that the Committee on Cleansing have had before them for some time the question of utilizing the surplus cinder fuel in raising steam for electric lighting purposes, and at the present time a special joint committee has been appointed to report on the subject.] The rougher rubbish, which is delivered at the lower end of the revolving screen, falls upon an endless web, which travels at the rate of 25 feet per minute. Women are engaged picking from it, as it passes along, anything which can be utilized or sold. Garbage and dirty straw, for instance,

go for manure; solder is extracted by a special furnace from the old meat tins; the tins, as they come from this furnace, as also old iron, old boots, &c., are sold. The remainder is delivered on the top of the cremating furnaces, through which it is passed, and the residum, drawn therefrom in the condition of slag or clinkers, is used for road making or filling up hollow ground. The foul air from the soil and mixing chambers is exhausted by means of a powerful fan, and conveyed under the bars of the cremating furnaces. It is thus purified before passing into the chimney, while, at the same time, it serves as a blast for the furnaces. Noxious odours are thus prevented escaping from the building. At the South Side Works special attention to this is being given. The exhauster will be still more powerful than the one at St. Rollox, and the pipes will be led under the furnace bars there also. But, in order to secure more thorough ventilation of the whole building, and also for light, we are forming a well, by leaving an aperture in each floor, 31 ft. by 22 ft. in the centre of the three-storey building, and a 3-ft. pipe will be led from the roof immediately above the well to the chimney. This stalk is 250 feet high, and is constructed with an inside chimney to the height of 60 ft., thus forming an annular chamber, about 2 ft. wide, into which the ventilating pipe referred to will be led.

Another new feature in these works will be a suite of Baths, for the use of the *employés* in the works and also the street and court scavengers of the district.

This sketch would not be complete without further reference to our mode of dealing with the street scavenge. I need not tell you that it rains very frequently in Glasgow. One of the consequences of our uncertain climate is that a very large and ever varying quantity of sweepings—often slushy—fall to be removed from our streets. What we have aimed at is to make provision at our Refuse Despatch Works for having all the street sweepings quickly disposed of along with the domestic and other refuse. For this purpose we have adopted a series of patent slush-tanks with sloping bottoms. In these tanks the water is rapidly forced to the surface by the downward pressure of the material upon the slope, and is drained off by means of the little slide plates in the front of the tank. By this means, in the short space of twenty-four hours, soft slush from the paved streets is rendered solid enough to be despatched by rail along with the other manurial refuse. Those tanks may be placed in a row, or front to front, or back to back, or set to form a square, or arranged radially round a common centre. They could conveniently be set on pillars and girder work high enough to permit of carts, waggons, or

boats being placed beneath them for the reception of the solids after draining. The sweepings of macadamized roads are drained in the same way. They are not, however, mixed with the saleable refuse, but are sent to Fulwood Moss Farm, ten miles distant. This is a farm of about 100 acres, which the Magistrates and Council four years ago leased for thirty-one years. At that time it was a heather bog, but it has now been thoroughly drained and reclaimed; and, with the application of road scrapings, yields good crops. A considerable part of the reclamation was done by the unemployed poor in the first months of 1879.

Such are the general arrangements of our cleansing department. You are not to suppose that I consider them perfect. All I can say is we are earnestly endeavouring to advance with the times, and to meet the requirements which sanitary science, experience, and common sense demand.

In regard to town scavenging generally, although there are points upon which a rule might be laid down for general application, it is quite obvious that the *modus operandi* must be determined in each case by local circumstances.

Speaking generally, there are two great preliminary provisions without which *no* town can be efficiently scavenged, viz.: —(1) Proper sewerage, and (2) suitable surfacing. (In regard to these I do not think Glasgow suffers by comparison with other cities.)

The foundation of efficient cleansing lies, like most other foundations, under the surface, and no town can be properly cleansed until it has been properly sewered. Nothing can be more obvious than this, unless it be the necessity for this first provision being followed up by its natural companion— a well-paved surface. I have always considered macadam very unsuitable for heavy street traffic. It is certainly very troublesome to a cleansing department, as in our climate a macadamised street is almost invariably disagreeable either from mud or dust. I agree with those who are of opinion that a street for bearing heavy traffic should have a good foundation of concrete to begin with, and whatever may be the material laid above it, whether stone, wood or other finishing, the surface thus formed should be rendered impervious by having the interstices grouted with cement or pitch. Such a street is easily scavenged.

I also attach great importance to the surfacing of back courts or yards. To have them laid either with well-jointed flags, asphalte, or other impervious surfacing, which will admit of regular and thorough hose washing is, in my opinion, absolutely essential to their efficient cleansing as well as to health. For this purpose undressed stones laid in ashes are

very objectionable. The interstices become almost immediately grouted with filth, and hose washing of such a surface only makes bad worse. I have great faith in hose washing, much more than in so-called deodorisers and disinfectants. In order to carry out this view, I might add a third essential to efficient scavenging, viz.: a liberal water supply, and I should stipulate for a plug in each court for hose-washing purposes. With these provisions, the scavenging of streets and courts in any town is simply a matter of good organisation and sustained attention.

It is in the collection, removal, and disposal of the general town refuse that the special circumstances in which they find themselves placed must guide corporations.

Human excrement, while being the most valuable constituent of town refuse, is, at the same time, the most difficult to deal with. How to dispose of it, is, therefore, the first question we have to consider. The filthy old system of combined privy and ashpit we put aside, as being quite out of the question. I take it that if this material is to be retained for manurial purposes it should be collected and removed in receptacles separately from the ordinary refuse. I am therefore led to compare the pail system of collecting, with the view to its utilization as manure, with the water-carriage system, which gets rid of it by flushing into the sewers. It is natural for one who is intrusted with the sale of city manure to be desirous of retaining the material which forms its chief value. Being in that position, I have been very unwilling, and am still sorry, to see it lost in the sewers. But being at the same time an officer of a health department, I must look at the question all round, and the more carefully I do so I become all the more fully convinced that water-carriage should and will prevail. That it is more comfortable and cleanly must be granted. In regard to the requirements of health, care and attention are necessary in either case. The situation of a water-closet, and its condition as to light, ventilation, flushing, and traps, are of course the salient points. On the other hand, the chief point in a pail-closet is that the contents be removed before they ferment or decompose. In either case the necessary conditions are, I believe, quite within the range of practicability.

Whether collection by the pail system will show better financial results than flushing into the sewers, must depend on the conditions of removal which are to be considered necessary for health. If these conditions were fulfilled by the old system of simply emptying the pail contents into the passing soil-cart, the financial policy of collecting it from the rears of dwelling-houses might be upheld. The case is quite altered, however, if we consider it necessary to have all used pails removed

bodily in covered vans, say not less frequently than twice a week, and clean pails put down in exchange. This would mean the removal of pails with only a trifling quantity in them, and the expense in that case would exceed any price which could possibly be obtained for the material as manure. I therefore conclude that the water system is more economical for dwelling-houses than a twice-a-week exchange pail system.

In the application of the water system to dwelling houses in block tenements, where one outside closet serves a number of families, I believe trough water closets, with the flushing arrangements under the control of the scavenging department, will prove the best. One very important point in favour of using water in such cases is that it admits of a more liberal number of seats in proportion to the families, whereas, with the exchange pail system, there is the inducement to cause as many families as possible to use one seat, in order to have a quantity worth taking away in the pail at each removal. Such a restriction must inevitably lead to a great amount of discomfort, more especially on Sundays, when, as a rule, all the members of a family are at home. For workshops, factories, and such places, however, where large numbers of workpeople are brought together, the pail system can be so regulated, that without inconvenience, the pails would be reasonably well filled at each removal. This being so, and seeing the excreta is of so much value to us in Glasgow in helping away the general refuse of the city, I have always recommended the pail system of collection from as many workshops as possible, when the closets are on the ground level.

The points which now remain for consideration are the collection and ultimate disposal of the general refuse. We all know that the more frequently refuse is removed, the better is it in a sanitary or health point of view. With regard to the mode, I think any system of collection which leads to or tends to encourage the keeping of refuse for any time inside of dwelling-houses should be guarded against. This is the chief objection, I see, to what is known as the bell-cart system if applied to dwelling-houses, especially smaller houses which have no inside water-closets. The bell-cart system suits very well for shops and business premises, and for its proper working uniform dust boxes should be used. But in my opinion it is desirable that provision be made in connection with dwelling-houses whereby the occupants can carry out their refuse at any time. In a town of self-contained dwelling-houses, each having its own backyard, I consider the portable box system, each box having a shed roof over it, very suitable. The circumstances are quite different, however, in a city like Glasgow, where all

the working classes, and in point of fact the great majority of the inhabitants, live in large tenements of several flats, with several houses on each flat. In that case one back court or yard is common to and used by a large number of families. We have 20, 40, 60, 80, and even 100 families using the same court, and it must be remembered that the back court is very much the children's play-ground. It is quite obvious that to have under these circumstances as many portable boxes placed in the court as would contain even one day's refuse from so many families would be out of the question. I know its weak points, but still I consider that a well formed and proportioned ash-house in the court is on the whole the best arrangement for such tenements. It should in any case have good ventilation. The floor should not be under the level of the yard, and it should be cemented inside. The door or opening should be large enough to admit of the refuse being easily thrown in as well as easily taken out, and the bottom of the opening should not be more than 30 inches high. The capacity of the receptacle should be regulated according to the number of families requiring to use it.

The question of ultimate disposal of city refuse must also, as in the case of collection, depend upon local circumstances. The refuse of a town whose excrementitious matter is all disposed of by water carriage cannot be said to be of great intrinsic value. Its practical value, however, as in the case of other goods, is what it will bring. We know that towns which command large tracts of agricultural land may, and in point of fact do, get money out of police manure of a quality inferior to that which other towns, differently situated, are compelled at considerable expense to destroy. In any case, however, there is the furnace to fall back upon. When the supply proves greater than the demand for manurial purposes, the supply can be curtailed by burning the worst of the material, and just as the demand decreases the burning power must increase. How the heat produced in the cremating furnaces can be most profitably utilised is, therefore, a question worthy of earnest consideration. I have no doubt some large seaport towns, where barges can be safely used for carrying the unsaleable refuse out to sea, will find this the cheapest and perhaps the best mode of getting rid of it; but comparatively few towns are in this position.

It was very aptly said by one of our great men that "dirt is matter in the wrong place." The task of health departments and cleansing masters is to discover the right place for it, and having arrested it in the very act of going wrong, to put it where it ought to be. This, however, like many other things, is "easier said than done."

Mr. G. W. MUIR, Glasgow, remarked that the elaborate system they saw depicted on the walls was imported from Manchester. He complained that there should be any such place as that at St. Rollox as described by Mr. Young, within the city at all. It was a great improvement, no doubt, on what used to be, but it ought not to be where it was—it was dirt, and it was in the wrong place. He contended that the existence of such a place within the city was a contravention of the Public Health Act. According to that statute, no collection of manure should be within fifty yards of any road or street or dwelling house, yet the works at St. Rollox were only separated from the public street by a wall. It might be very well for those who resided at a distance to say that they were not a nuisance, but from personal investigation and inquiry among the inhabitants who had to submit to the odours all the year round he found that they complained most bitterly of them as a nuisance.

Professor GAIRDNER thought the tone and temper of Mr. Muir's remarks were better passed over without comment. The whole character of Mr. Young's paper showed that his heart was in his work, and it bore a very distinct sense of his grappling with the work and trying to do everything in the best possible way. As Mr. Young had said, the work was not of a kind that was popular, and all that was done was open to remark from persons who were determined to find fault. In order to know what had been done in Glasgow in this matter it was necessary to look back, not, perhaps, to the time when Dr. Arnott visited Glasgow and found court behind court filled with families, while in the centre there was a piled-up midden that was sold for the benefit of the dwellers in the court, so that, as Dr. Arnott described it, the people were literally living upon the produce of their own filth, and jealously guarding it against being removed by the authorities. That was the original state of Glasgow, and that was what they had been gradually getting away from. After alluding to the unsatisfactory system of cleansing by contract which prevailed at the time when he was medical officer of health, Professor Gairdner said he was very glad that Mr. Young regarded himself as an officer of the Health Department, because he could not conceive of the cleansing of a town being well managed where the scavenging was not part of the work of that Department.

Mr. HONEYMAN said he had listened with much pleasure to Mr. Young's admirable paper. He believed that few of the citizens were aware of all that had just been communicated to the Congress regarding the great works now in operation with the view of keeping the city clean. It had occurred to him to ask Mr. Young as to the sanitary effect of sweeping the streets by the horse sweeper instead of with the oldfashioned hand broom. He thought, perhaps, that the horse machine moving diagonally across the channels, left an accumulation of filth which the old broom used to clear out. Then as to the uplifting with the bell-cart he had been pleased to hear that Mr. Young had come to the conclusion that the proper method was to

have a uniform size of covered box. As it was, in some of their streets up till 10 a.m. boxes of every conceivable shape and size could be seen filled with refuse. He had seen baskets, soap boxes, orange boxes, and even bandboxes, and the result was in the latter case when the men lifted them that the bottoms fell out and the refuse fell to the ground. To make matters worse, old women could be seen poking about these boxes, and altogether the streets up till that hour and long afterwards presented a more slovenly appearance than any place he had seen with the exception perhaps of Bristol.

Dr. A. CARPENTER said he had had an opportunity of going over the works described by Mr. Young, and since then he had heard him read his paper. He had to confess that it appeared to be an advance by a great deal on similar works in other towns. The smell was dealt with as far as human ingenuity could deal with it in an efficient manner, and it had been reduced to a minimum. There was another principle which he thought highly favourable in connection with these works—they were not destructive. It was to him a very great and serious evil when he saw material of value destroyed simply for the purpose of getting rid of it. At St. Rollox, however, they had made arrangements for utilising everything that was likely to be useful; and the manner in which that was carried on appeared to him to be as little objectionable as anything of the kind possibly could be within the midst of a great population. One objected very much, unless it was absolutely necessary, to the pail system; but still this system could be carried on so that it should not be a serious nuisance, at least not a nuisance injurious to the health, and it appeared to him that the way in which they were managed rendered them as little injurious to health as it was possible for them to be. In regard to the disposal of the manure, it was important that farmers should get it before putrefaction had deprived it of its value. If it was brought into contact with the ground as soon as possible it would be valuable, but if it was stored until after putrefaction it would be comparatively valueless, and the farmers would find that they had not their money's worth. There was one benefit which the 2,400 farmers who were customers of Mr. Young derived from the manure being sent off in waggons as quickly as possible, and that was that they would get it on the land before putrefaction had deprived it of its value. He could not let the opportunity pass without expressing his full approval of the condition of things he had seen at St. Rollox. He felt that that was a specimen of work that might very well be copied by the London Authorities, because there was nothing at all equal to it in the Metropolis. A proposal had been considered by the Sanitary Authorities of the City of London for destroying entirely the whole of the refuse that they collected from the streets, ashpits, stables, and cow-houses, because it would cost something like 12s. a ton to take it to the outside of the city, while it would be worth only half-a-crown when it got there. He was opposed to such a proposal, because he thought it would result in injury to the country. He was glad that the Corporation of Glasgow had avoided such a course. The paper which

Mr. Young had read was one worthy of the Congress, and he, for one, was extremely grateful to that gentleman for having placed it before them.

Professor ROBINSON said the paper was one of the most useful that had been read to the Congress. The subject it dealt with had been engaging the attention of every Local Authority in the country, and every sanitary department had been exercising itself as to the proper method of dealing with the refuse that was collected in its locality. He would express no opinion as to the cost of dealing with such refuse, but he was of opinion that nothing should be destroyed. Sound, reliable data was what they required, and the paper just read afforded them all the information they could desire on the subject.

Mr. ALEXANDER FREW, Glasgow, wished to inform the Congress that there were about ten burghs clustered around Glasgow which were all under separate authorities. That alone, he thought, was a great drawback to the proper direction of sanitary work in Glasgow. The work of the Glasgow Sanitary Department, he had reason to believe, was carried on in the most satisfactory way, but he would just tell them how sanitary matters were managed in one of the most fashionable burghs outside of Glasgow. Behind a terrace of self-contained houses there were 10 or 12 ashpits within a few feet of the back wall. These pits were built of brick, and the refuse thrown into them was generally allowed to lie for six months before being removed, or at the best the places were not cleaned out oftener than three times a year. Surface water got into the pits, the rubbish decomposed, and a most abominable smell was created. When this refuse was carted away it was not taken to the country or burned, or anything of that kind. It was taken out by the back door and put in front of another terrace. It was put into a large area of low-lying ground, and then covered over with six or eight inches of soil, and in the course of a few years a board was put up bearing the words—"This eligible site to feu." Such a state of things ought not to be allowed to exist, and the only remedy was for the Glasgow authorities to make a bold step and sweep the whole of these little burghs into the city.

Mr. YOUNG expressed his thanks for the kind reception and favourable criticism of his paper. In reply to Mr. Honeyman, he said the work executed by the horse machine was far more perfect than that done by hand. On a paved street the revolving brush cleaned out the spaces between the stones more effectively, and altogether the work was better done than men with hand brushes could be got to do it. In regard to the other point referred to by Mr. Honeyman, he said that the great variety of unsuitable and unsightly boxes used for laying out refuse for the morning bell-carts did cause a great deal of paper and dust to be strewn upon the newly swept streets every morning, and this annoyed him more than it did anybody else, as he

had to see that the streets were kept clean. He had, however, recently contracted for a supply of uniform covered boxes suitable for the purpose. Some of these were already in use, and it was expected that the public would soon come to see the benefit of adopting them.

"*Remarks on the Ventilation of Sewers and House Drains*," *by* J. WALLACE PEGGS, Assoc.M.Inst.C.E.

The system of sewers and house drains of a town has been likened to a huge machine, requiring constant and careful attention to keep it in proper working order. Perhaps the most important part of this machine is that having relation to the ventilation, with which is connected the question of regular flushing.

Judging from the work which is carried out daily around us, we must come to the conclusion that the question of ventilation for sewers and house drains is very little understood even now; and it may be well here to state what we really mean by the term ventilation as applied to sewers.

It used to be considered that the object of ventilation was to let out pressure of sewer air, and small openings and relief pipes were accordingly made, and considered sufficient to effect this purpose. A little consideration will, however, show that small openings are not sufficient even for the relief of pressure.

I will give one instance of this, taking a case occurring in house drainage work. It is very usual in large buildings to have one vertical soil pipe, which receives a number of closets and slop sinks. When a pailful of slops is poured down one of the upper sinks, this creates in the first instance pressure of the air in the lower part of the pipe, and afterwards a partial vacuum. The effect of this is, if the pipe is not ventilated, that some of the traps are unsealed, either by having the water blown out or sucked out of them. In fact, cases are on record where a pail of water poured down a slop sink at the top of a long soil pipe has unsealed all the traps of the closets and sinks below.

The remedy for this is to ventilate the soil pipe, so as to prevent either undue pressure or partial vacuum. A small pipe

however is quite useless for this purpose, as it will not admit air to pass through it with sufficient rapidity to prevent the blowing out, or sucking out, the water of the traps.

However necessary the relief of pressure may be, it is now well known that this is not the most important object of ventilation.

The true principle of ventilation for sewers and house drains is to have the foul air constantly replaced by the admission of fresh air. A sewer must always have a constant current of air passing through it, in the same way that sewage matters in it must be in constant motion. There must be no resting places, either for air or for sewage matters, in a well constructed system of sewers. This is the fundamental principle which should regulate all sewerage and drainage. Wherever trouble occurs, it will almost always be found to have arisen from the violation of this principle.

The author's experience is that there are few, if any, towns which have been sewered but that the nuisance of ventilation at the surface of the streets has been complained of. Now what does this mean? It is really an indication that something is wrong in that system of sewerage, or in the house drainage connecting therewith.

The popular notion is that all sewers must of necessity be foul and objectionable, but this is quite a mistake. A system of sewers which is so constructed as to have no resting places for foul matters either in the main sewers themselves or in any of the branches or house drains, will not emit foul gases, and the question of ventilation in such a system is therefore greatly simplified.

In sewers of this kind it would be quite possible to adopt such extensive ventilation that any slight odour which existed in them would be so diluted as to be absolutely imperceptible.

It will be said that the above is an imaginary state of affairs, as there is no town in existence in which the whole of the sewers and drains are constructed so perfectly as not to retain foul matter in any part of them. The author cannot by any means admit that this is so, at the same time there can be no doubt that in the vast majority of towns considerable portions of the sewers and drains are so constructed that they are not self-cleansing, and therefore became sewers of deposit. Even in such cases, however, wonderful improvements may be produced by a regular system of flushing.

By this it is not meant the occasional flushing of once every month or two as ordinarily carried out, but regular automatic flushing once every day or two.

Appliances for automatic flushing will be found in the Exhi-

bition now being held in this city. The branches and terminal portions of sewers are those requiring the most careful and frequent flushing as the flow of sewage in these portions is small, and the deposit does not get washed away rapidly. In fact, if all the branches of a sewer were kept properly and regularly flushed, the main sewers would of necessity become so.

The ideal sewer, no doubt, would be one open from end to end to the fresh air, and although, as towns are now built, this would be impracticable, the author would go so far as to say that the nearer we approach that ideal the better.

Dr. Richardson, in his report on Brighton, where there have been such serious complaints of the nuisance from the street ventilators, has very clearly recommended something approaching the ideal I have mentioned. He there proposes to open at some twenty different parts of the town the space between existing manholes, and to build up large rectangular chambers to be covered with open ironwork to give ventilation to the sewer. He also proposes to use these chambers for flushing purposes.

Sir Robert Rawlinson, in his valuable "Suggestions" advises that—

Ventilation should be provided for on all sewers at frequent intervals, not greater than 100 yards apart, and adds the very suggestive remark "If, however, it is found that some of the ventilators are a nuisance, additional sewer ventilation should be provided at shorter intervals."

The following remarks apply to the ventilation of house drains, but the principles involved in them are equally applicable to the ventilation of sewers.

The most recent authoritative statement we have on this subject is contained in the model bye-laws recently issued by the Local Government Board of England for the use of local boards of health, and other sanitary authorities.

In these bye-laws, which have met with very general approval among the most eminent sanitarians, it is laid down as follows:—

Every ventilating pipe or shaft used shall be of a sectional area not less than that of the drain with which such pipe or shaft may communicate, and not less, in any case, than that of a pipe four inches in diameter. It is also laid down that no bend or angle shall, except where unavoidable, be formed in any ventilating pipe or shaft.

The question of ventilation is so very important for the efficient action of a system of house drainage, that the author has thought it to be of some interest to this meeting to show how far the above admirable rules are being complied with, or rather not complied with, in actual practice.

The examples upon the diagram give a number of cases t from work of recent construction, or in course of construct around some of the suburbs of London; and will show glance, the kind of work which is being carried out u various local authorities.

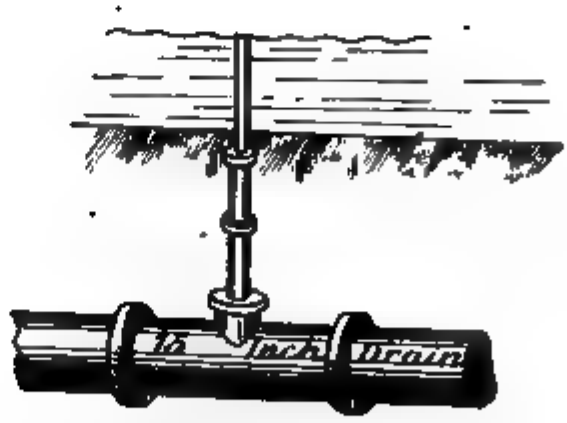
The really good work of sanitation, as regards house drain is very limited, and from large experience in such matters, author finds that as a rule, the efforts made are to effect an side show and leave the real mischief undisturbed. It is v usual to find that ventilating pipes with cowls, more or ornamental, have been run about buildings in all directions, all kind of angles, while the old drains, choked with depo are left untouched. This kind of work makes, of course goodly show for sanitation; and one is often taken to th cowls to be shown how effectively they are working beca smell is freely emitted. While of course the retort, the old dra remains, generating the sewer air, a foul smell will be emitt but it should be distinctly understood that in a proper system drains the ventilating pipes emit little or no odour. Th proper function is to create a constant current of air, and dilute any sewer air which may be generated.

CASE A (Peckham).—This case is a very common one, and not peculiar to any particular district. The sketch A sho the 4 inch soil pipe continued upwards by a 3 inch pipe used f taking roof water, and terminating with a hopper head in fro of a window. The joints in this particular case are left ope and the arrows indicate the direction which sewer air ma take into the house. There are very few cases where a rai water pipe may be usefully employed for drain ventilation; an it is better to lay down the rule that rain-water pipes shall n be so used.

CASE B (Wood Green).—This case is to illustrate the ver usual way of providing ventilation to a soil pipe. From th 4 inch soil pipe a smaller pipe, 1½ inch diameter is taken, an made to bend in all directions and around the overhangin gutters, terminating under the coping. This kind of ventilatio is utterly worthless, and in the particular case under con sideration is, in reality, no ventilation at all.

CASE C (Wood Green).—This is another illustration where a 4 inch soil pipe is ventilated by the 1 inch pipe, as shown in the diagram. It will be seen that the 1 inch pipe is taken round the gutters with five separate bends, and finally terminates in front of a dormer window. Every time a water closet in the house is used the pressure in the soil pipe is relieved, to a certain extent, by this small pipe, and foul air escapes at the window level.

H



J.Wallace Peggs C.E.

CASE D (Tottenham).—This illustrates another case of ventilating a 4-inch soil pipe by a 1-inch pipe carried up with numerous bends round the rain water pipe and stone coping.

CASE E (Kensington).—The sketch at E shews the ventilation of two soil pipes by a continuation in the zig-zag direction shewn. The pipe is three inches in diameter and has seven bends, and finally finishes at the back of a chimney stack, and is surmounted by a cowl.

CASE F (Large Asylum).—This is one of the most peculiar examples of ventilation in the author's experience, and occurs at a large asylum near London. The 4-inch soil pipe is continued in the directions shewn, with 2½-inch pipe, having nine bends. There are no less than thirteen of these ventilating shafts at this establishment, terminating at the chimney stacks, and sometimes there are two to one stack. The pipes are in every instance terminated by a cowl of fantastic construction. It is hardly necessary to say that the appearance of this building is altogether spoiled by this attempt at sanitation.

CASE G (Westminster).—This is another example of recent sanitation. The 4-inch soil pipe is continued by an inch and a quarter pipe, having six bends, and ending with a T piece. The arrangement here is very unsightly, and quite useless for the purpose it was intended.

CASE H (Wood Green).—This shews another example of ventilation for two soil pipes. The ventilating pipe is 1¾ inch, and is intended to ventilate two 4-inch soil pipes, no enlargement being made at the junction (see diagram). There are 12 bends in this ventilating pipe to carry it around rain-water pipes and gutters, and finally terminating just above a dormer window. This example speaks for itself, and requires no further explanation.

CASE I (Large Asylum).—This case is a very interesting one, for the particulars of which I am indebted to Mr. Rogers Field, M.Inst.C.E. The drainage of this asylum had been recently remodelled. Mr. Field was called in to advise and report upon the drainage arrangements, and among other things found that the main drain from the buildings, a 15 inch pipe, was ventilated only by four such ventilators as shown in the diagram. Each of these ventilators consisted of a long length of 1½ inch wrought iron pipe with several bends, and upon the upper end a box containing small trays of charcoal was fixed. Upon examination it was found that the ventilating space was ⅔rds of a square inch, or less than $\frac{1}{250}$th part of the area of the sewer to be ventilated. This area was further reduced by the charcoal, so that the drain was practically unventilated.

The value of ventilation to a drain was strikingly shown

during the examination of this building. Holes were made at frequent intervals along the drain for the purposes of inspection, and at first the escape of sewer air proved a great nuisance; but after a few days, the holes being left still open, the drain became ventilated, and no nuisance from the escape of sewer air was then experienced.

On "Ventilation of Street Sewers," by W. P. Buchan.

It is understood first, that a proper disconnecting ventilating trap is put in upon the house drain between each house and the sewer, so as to prevent aërial communication between the sewer and the house drains inside of the trap. The sewer may then be ventilated in three ways:—

First. By gratings in the middle of the street, all the gully traps at the edge of pavement being trapped, and in connection with these gratings, and to assist in causing them to act as fresh air inlets, ventilating pipes may be put in from the outer side of the disconnecting traps above referred to, and carried up the outside of the houses (or other convenient places) as high as possible, and which pipes may be fitted with Fixed Exhaust Ventilators to assist in causing the foul air in the sewer to be discharged at as high a level above the houses as possible.

Second. By closing up the gratings in the middle of the street—especially where these cause a nuisance—and while still using the ventilating pipes above referred to, to put up high level ventilating pipes to admit fresh air, while the high level outlet pipes in first style continue to act as outlets. Or where sufficient of the pipes from the outside of the traps above referred to have been put in or are in, that a number of these should have exhaust ventilators upon them, and a number without, or blow-in ventilators may be put upon some. When the drain from the house enters the sewer too low below its top, the outlet ventilating pipe may have to be led off from or near the crown or top of the sewer, or from a man hole,

Third. That where it is desired to prevent the air from a main sewer going back into the side sewers branching into it, or the air from one part of a main sewer going into another part, as *e.g.*, where nauseous discharges may be sent into a sewer from some chemical or other work, or slaughter-house, or hospital, &c., there be put in an accessible disconnecting ventilating

trap or traps as may be necessary, either upon the line of the main sewer, or upon the branch sewers. In the latter case, one trap being placed upon the branch sewer near its junction with the main sewer. This branch sewer, or portion of sewer, may be then ventilated by admitting fresh air into it at one end, either by a grating in or near the middle of the street, or other convenient place, or by a pipe or pipes conveying fresh air down from a high level in any convenient manner, while the foul air in the sewer is to be carried off by a pipe or pipes carried up from the other end of this branch sewer, or portion of sewer, desired to be ventilated by itself; and which outlet ventilating pipes are to be placed as high as convenient or possible, and as high above the houses as possible, and to be surmounted by fixed exhaust ventilators, so as to cause a current of fresh air to continually pass into the sewer, or portion of sewer, at the one end and to be discharged at the necessary high level at the other end; all so as to prevent bad air or bad smells from the sewers being felt or breathed by people in the streets, and to cause the said bad air to be discharged above the houses, so that it may be the more readily carried off by the wind innocuously. It is understood that all street gullies are trapped, and that no air gets into or out of the sewer except through the particular inlets or outlets above referred to. I have had this sectional system of trapping and ventilating street sewers in operation at Dalmuir, near Glasgow, since the summer of 1879.

SECTION III.

CHEMISTRY, METEOROLOGY AND GEOLOGY.

ADDRESS

BY R. ANGUS SMITH, LL.D., Ph.D., F.R.S., F.C.S., &c.

PRESIDENT OF THE SECTION.

LADIES AND GENTLEMEN,—The history of this Institute is not a long one, if we look to its name only; but if we look at it as the result of a great national movement which has been in progress for fully forty years, we shall find that it is full of interest.

Attention to health has been more or less the subject of thought, of writing, and of legislation, from the earliest times, and you have already heard opinions given by the early Egyptians, Israelites, Greeks, and Romans, coming down to our own time. A few scientific thinkers have occasionally in ancient days attempted to lay down laws, and their attempts, more or less well founded, are interesting; but perhaps in olden times the most careful attention to health was observed chiefly amongst the wealthy, and, as a national movement, we are not aware that in any country it was widespread, although separate acts of legislation are to be found amongst the nations mentioned. It is not my intention to go back to history, but I cannot help making some slight reference to our more immediate past, at the time when the nations of Europe, and, we may say, of the four continents, have been agitated by fears regarding the great epidemic which is still unsuppressed in Egypt.

It would not be boasting if we were to speak with some satisfaction of the work which this country has done in the cause of national health, when we have seen so many writers on the Continent discussing our modes of operation, and showing

dissatisfaction with systems which have been so carefully thought out. It is difficult to tell in what country of the most civilized parts of Europe the first ideas on any subject chiefly arise. There are many men who are considered to be the first promoters of an object who, after years, have been found to have been preceded a long time by others; but it surely can be a matter of little doubt that in sanitary practice relating to public health, and its attempt to scatter that knowledge and practice widely amongst the people, England has been the first amongst nations. To those who travel much upon the Continent even in places most advanced in material civilization, it is still a wonder that the crude appliances for cleansing towns or houses which are everywhere observed can be tolerated; and it is a common thing for people of this country to refuse to travel abroad, or to prefer to confine their travels in certain directions, only because of the discomfort arising from habits offensive to the senses and to health. I think it is fair at this time to make this claim; and whilst I make it for England, I am sorry not to be able to say that Scotland preceded her; but, at least, I am glad that the principles and practices worked out in the former country have taken such deep root in the North, and that the comfort of life has been greatly increased amongst the population since the time when I spent my early days in Glasgow. This work has not been done without the anxious and severe labour of many men: nearly a whole generation of enquirers may be said to have died in the struggle. Nevertheless, the leader of them all is still amongst us; and one can scarcely speak upon the subject of Sanitary Reform without mentioning the name of Edwin Chadwick. I doubt if his labours are sufficiently known even now to the general public; but, having had the pleasure and the advantage of being at an early period of life more or less associated with him in his work, I am one of those who have had the opportunity of witnessing his earnestness, his unselfishness, and his power.

It is not easy to tell how many lives he has saved, although calculations have been made on good foundations; but even the number of lives which he has saved would give a small idea of his merits, because we must also take into consideration the enormous amount of discomfort and imperfect health which sanitary appliances remove. Surely we ought to honour such a man. To have led an army so as to have killed but a small portion of those whose lives he has saved would probably have given him the rank of a leader, a Dux—a duke. Can the nation not give him some equivalent honour, or put some stamp on the noble metal of his life?

But whilst we look on the progress of this country in matters

relating to public health, and take to ourselves that honour which we think is our desert, we cannot have any feeling but pleasure when we look at the work of a scientific kind which has been done on the Continent, and which is at this present moment claiming the attention of all sanitary reformers. The work done by Pasteur in France is of a kind which cannot be too highly admired. He has probed into the more immediate causes of disease in man, in the lower animals, and in plants, and he has found results scarcely suspected even by those who for a long time had believed that the microscope would continue to reveal to us many wonderful and important secrets. It is true that in very early days it was suspected even by Terentius Varro that small animals in the air and low places in swampy grounds produced disease in man, a suspicion founded on what observations we have no means of knowing. The history of the microscope from the days of Leeuwenhoek is a history of marvels; but during the days of Pasteur the marvels must have astonished even its greatest admirers. There have no doubt been many workers besides Pasteur, but I have selected in the case of England only one name—one that seemed eminent amongst all others in promoting the cause of public health; and I think it fair to bring forward Pasteur prominently before you, although you are already familiar with his name, and I am not quite sure if it be not the case that, by some peculiarity of the action of fame, his name is better known in this country than even that of Edwin Chadwick.

If I mention Pasteur at present it is in order that I may allude to one of his latest discoveries, viz., the attenuation of the virus of at least one disease, viz., that of chicken cholera, by the action of air or oxygen. I do this because it comes in well with the object which I have in view in this address, specially to call attention to the action of oxygen; it is an old subject but not exhausted, and I hope you will not be too much wearied by listening to the advantages of pure air. It may be well to quote Pasteur's words—

"Now that we have arrived at this point a question presents itself which relates to the cause of the attenuation of virulence.

"The cultivations of our virus must take place in contact with air, because our virus is aërobian, and, without air, its development becomes impossible. We are, then, naturally led to ask whether the attenuation of the virus is not due to contact with the oxygen of air? Would it not be possible that the small organism which constitutes the virus, when left in contact with the oxygen of pure air, in the medium of cultivation in which it has developed, may have been modified, and the change remain permanent, even after the organism has been withdrawn from

the modifying influence? We may also enquire whether some chemical principle in the atmosphere, other than oxygen, does not intervene in this phenomenon, the singularity of which almost justifies my hypothesis.

"It is easy to understand that the solution of this problem, in case it depends on our first hypothesis, that the phenomenon is due to the oxygen in the atmosphere, may be tried by experiment. If oxygen is in reality the cause of the attenuation of virulence we may have, to a certain degree, a proof of it by noting the effect of suppressing it.

"To test this, let us conduct our cultivations in the following manner:—We may take a certain quantity of our chicken broth and place in it the most virulent virus, and fill with it a series of glass tubes up to two-thirds, three-quarters, &c., of their volumes. These tubes may then be closed over the lamp. By the presence of the small quantity of air left above the liquid the development of the virus may be started, which is ascertained by the increasing turbidity of the liquid. The development of the cultivation gradually absorbs all the oxygen contained in the tube. The turbidity then diminishes, the growth is deposited on the sides of the tube, and the liquid becomes limpid. This takes place generally in two or three days. The microscopic organism is then deprived of oxygen, and will remain in this condition as long as the tube is not opened. What will become of its virulence? To be sure of our results, we will have prepared a great number of such tubes, and an equal number of flasks, which last, will continue to be left in contact with pure air. We have already spoken of what becomes of cultivations carried on in presence of air. We know that they experience a progressive attenuation of their virulence, and we will not return to this subject. Let us now only pay attention to the cultivations in closed tubes. Let us open them—one after an inverval of a month, another after three months, and so on until we open one that has stood ten months. I have not gone any further at the present time. It is a remarkable circumstance, that the virulence in all these cases is of the same degree as that of the liquid which served to fill up the tubes. As to the cultivation exposed to the air, they are found either dead, or in a condition of feebler virulence.

"The question we have proposed is then solved: it is the oxygen of the air which attenuates and extinguishes the virulence.

"To all appearances we have here what is more than an isolated fact. We must have reached to a general principle. We may suppose that an action which is inherent to atmospheric oxygen, an agent present everywhere, has the same influence on other viruses. At any rate it is worthy of interest that possibly

a general cause of attenuation exists dependent on an agent which is in a manner cosmical. Can we not suppose, even now, that it is to this cause that we can attribute in the present, as in the past, the limits set to great epidemics?

"The facts which I have had the honour to communicate to the Academy suggest many proximate and remote inductions. From all these I must hold back with reserve. I will not feel authorised to present them to the public unless I make them pass into the domain of demonstrated truths."

It was an Englishman that discovered oxygen—Priestley. He called it vital air, with a due appreciation of its wonderful powers. It was a Frenchman, Lavoisier, who gave it, we may say, its scientific work to do, and called it by its present name. The two nations have worked together for many years, thinking on similar subjects, whether friendly or at war.

If we leave for a moment the attention to individual workers, and consider the ordinary observation of moderately observing men, we find how wonderful is the difference noticed between places and objects which have been closely shut up and those which have had the clear sweep of the air of heaven upon them. We call the former places close or musty, or depressing, or in various ways endeavour to define our objections to them. The Arab, in the free air of the desert, is afraid of even the outskirts of a town. Some people can smell great cities at a considerable distance, and coming this year from wandering about Norwegian seas and valleys, I fear I was right in thinking that I had acquired the power of perceiving the near approach of places supposed to be intensely civilised.

When a room is shut up even for a day, unless the room be very large indeed, there is always that peculiarity observed by sensitive persons, to which would be given the name of closeness. Yet there are people who do not seem to observe this, and who live their lives in rooms in which this closeness may be constantly observed. I have often reflected on this peculiar condition. Surely, if oxygen removed all impurities, these impurities ought to have been removed, since the oxygen of the air is never absent from these rooms, except to such a small extent that the estimation of the change is extremely difficult. If we lift up a window and allow the air to blow into the room, so as entirely to replace the original air, we do not at all times attain sufficient aëration. It takes but a few minutes in a climate like this, where there is considerable motion of the air, to renew the atmosphere of a room entirely; we may judge of this by making a trial upon a visible atmosphere, viz., one pretty well filled with smoke. We see how rapidly with an open window every trace may be removed from the farthest corner, and yet

this new air is not sufficient to refresh the room, and closeness is the characteristic still complained of. It is the custom in well regulated houses not merely to renew the air, but to cause the air to blow through the house for a considerable time every day when the weather permits it. Knowing this for a long time, I wondered very much what was the reason. Surely, I said, there was vital air enough without this long continued current.

Then that remarkable discovery made by Schönbein came to my mind, as I suppose it has to the minds of many other chemists, and I thought it must be the ozone in the air that does the work, and as there is little ozone in a volume the air requires many repetitions of bulk. There may be some truth in this still; but whether, because the air receives imperfect contact with the substances to be purified, or whether the mechanical action of the current is necessary, or some other cause, it is certain that a continual current is necessary for perfect purification. Looking further at this subject, it occurred to me that really clean houses were preserved in this condition by something more than currents of air generally, and that good housewives resorted to the practical method of rubbing by hand, and it seemed clear that no furniture could be preserved from that peculiar condition of mustiness in any house where the doors and windows must be frequently closed, unless the absolute removal of certain substances from the surface were resorted to. And what was this substance that required to be removed? I suppose it to be one of organic origin. In speaking of this, perhaps you will excuse me if I enter with more detail upon my own work than the works of other men. I shall, naturally, feel more at home; and as this Institute will take care that you are made acquainted with all the discoveries relating to sanitary appliances made in all parts of the world, this may be a reason for contracting the field of my observations, and I cannot hope to keep your attention so long as a consideration of the whole range of enquiry would demand, even if I had power to speak so widely.

I may here bring in an account of an enquiry concerning ammonia, which will explain some of my meaning. It is taken from the Memoirs of the Literary and Philosophical Society of Manchester:—

"If organic matter is everywhere, the presence of ammonia is everywhere possible; and if that matter is decomposing, ammonia is everywhere. That is the general statement which this paper illustrates. It is now many years since it was observed by me that organic matter could be found on surfaces exposed to exhalations from human beings; but it is not

till now that the full significance of the fact has shone on me, and the practical results that may be drawn from it in hygiene and meteorology. These results are the great extension of the idea that ammonia may be an index of decayed matter. The idea itself has been used partly, and to a large extent—as illustrated in my 'Air and Rain;' the facts now to be given enable us to claim for it a still more important place. The application seems to fit well the conditions already examined; and by this means currents from foul places have been readily found. This does not apply to the substances which may be called germs, whether it be possible to see them or not, because these are not bodies which have passed into the ammoniacal stage, although some of them may be passing—those, for example, which are purely chemical and exert what we may call *idiolytic* action.

"Ammonia must ever be one of the most interesting of chemical compounds. It comes from all living organisms, and is equally necessary to build them up. To do this, it must be wherever plants or animals grow or decay. As it is volatile, some of it is launched into the air, on its escape from combination; and in the air it is always found. As it is soluble in water, it is found wherever we find water on the surface of the earth, or in the air, and probably in all natural waters, even the deepest and most purified. As a part of the atmosphere, it touches all substances and can be found on many; it is in reality universally on the surface of the earth in the presence of men and animals, perhaps attached more or less to all objects, but especially to all found within human habitations, and, we might also add with equal certainty, the habitations of all animals.

"If you pick up a stone in the city and wash off the matter on the surface, you will find the water to contain ammonia. If you wash a chair or a table or anything in a room, you will find ammonia in the washing; and if you wash your hands you will find the same; and your paper, your pen, your table-cloth, and clothes, all show ammonia; and even the glass cover to an ornament has retained some on its surface. You will find it, not to be a permanent part of the glass, because you require only to wash with pure water once or twice, and then you will obtain a washing which contains no ammonia; it is only superficial.

"This ammonia on the surface is partly the result of the decomposition, continually taking place, of organic matter adhering to everything in dwellings. The presence of organic matter is easily accounted for; but it is less easily detected than ammonia. It is probable that the chief cause of the presence of ammonia on surfaces in houses and near habitations is the

direct decomposition of organic matter on the spot. If so, being more readily observed than organic matter itself, it may be taken as a test, and the amount will be a measure of the impurity. A room that has a smell indicating recent residence will, in a certain time, have its objects covered with organic matter; and this will be indicated by ammonia on the surface of objects. After some preliminary trials, seeing this remarkable constancy of comparative results and the beautiful gradations of amount, it occurred to me that the same substance must be found on all objects around us, whether in a town or not. I therefore went a mile from the outskirts of Manchester and examined the objects on the way. Stones that not twenty hours before had been washed by rain, showed ammonia. It is true that the rain of Manchester contains it also; but, considering that only a thin layer would be evaporated from these stones, it was remarkable that they indicated the existence of any. The surface of wood was examined; palings, railings, branches of trees, grass (not very green at the time), all showed ammonia in no very small quantities. It seemed as if the whole visible surface around had ammonia. I went into the houses and examined the surfaces in rooms empty and inhabited, tables, chairs, walls, plates, glasses, and drawing-room ornaments. A (Parian) porcelain statuette under a glass showed some ammonia; a candlestick of the same material (but uncovered) showed much more. The back of a chair showed ammonia; when rubbed with a common duster, there was very little. It seemed clear that ammonia stuck to everything.

"If, then, ammonia was everywhere, the conclusion seemed to be that it was not at all necessary to do as I had been doing—namely, wash the air so laboriously; it would be quite sufficient to suspend a piece of glass and allow the ammonia to settle upon it. For this purpose small flasks were hung in various parts of the laboratory, and examined daily. The flasks would hold about six ounces of liquid; but they were empty; and the outer surface was washed with pure water by means of a spray-bottle: it was done rapidly, and not above 20 cub. centims. (two-thirds of an ounce) of water was used. This was tested for ammonia at once with the Nessler solution. The second washing, taken immediately, produced no appearance of ammonia. Ammonia could be observed after an hour and a half's exposure at any rate; but I do not know the shortest period."

To me it seemed perfectly clear that the character of closeness was connected with the existence of organic matter, and the organic matter with the ammonia. That ammonia should be found almost everywhere, but in small quantities, was not to be wondered at, considering the universal presence of organic

matter in the air and waters of the world. It was when considering these things, and the effect of oxygen on this organic matter, that I came to the conclusion that long continued currents of air either carried away the organic matter with it, decomposing it and turning it into gases, or, if it were not possible for the oxygen alone to do this, it might happen that the oxygen destroyed those miuute forms which have been shown to be concomitant with putrefaction and decay. A similar mode of thought had previously led me to consider that it was the want of this excess of oxygen that caused confined sewer gases to be so dangerous, whilst the enormous amount of gases coming from decomposing matter, such as on the Clyde, seemed to pass away, leaving comparatively little effect beyond the disgust and the sickness of the present,—but to this point I must return. On speaking of the subject I might as well quote my own words to save the trouble of a second expression (see Proceedings of the Philosophical Society of Glasgow, 1880):—

"This raises a question to be solved; but the fact is certain that fevers have not been traced to the escape of gases of putrefaction when there has been a large amount of water and exposure to the air. But they have been found when the water is not very great in amount, and the decomposition is made under cover, as in sewers. The question arises—Is this owing to the concentration, or to the difference of decomposition in darkness, or to the better supply of oxygen? The effect of sunlight in warm countries does not allow us to suppose that the daylight always produces in vapours an innocent state, although it has a great effect in that direction when there is little water. With us, at least, innocence in the atmosphere seems to be rather something connected with the abundance of air in proportion to the impurity. This air, again, may act in two ways. It may act by rapid oxidation of the substances in water, or by dilution of the gases when formed; and the destruction of putrid matter in water is really very rapid when plenty of air is allowed. This air is brought to the Clyde by the water, and also by the waves, both artificial and natural, exposing a great deal of surface. The air may act also merely by rapid dispersion of the gases. Still we must not forget that these gases or vapours are not reported to us to produce any marked type of disease over the Clyde, even when they come in a state so concentrated as to produce sickness; whereas gases from sewers, in a condition which may not produce immediate illness, may produce in time typhoid fever, as we are credibly informed. We must conclude, then, that it is not mere dispersion, but that it is a more thorough putrefaction and oxidation which takes place in the Clyde, and a more complete destruction of the organic

substance by the abundance of air, than can take place in sewer water, whatever the senses may indicate to us. Of course, we must ever give some credit to the flow of air up the river, and the ever-fresh breezes that come from the Atlantic, as well as the mixture of air with water caused by steamers."

If nature had contrived no method of destroying such seeds of death populations such as this is would never have grown up. And what is the method? That method is, first, putrefaction, at least I know of none other, except the concluding portion of the work, viz., thorough oxidation. When, therefore, you see the Clyde seething with gases of putrefaction, and when you smell it to such an extent that a feeling of loathing is produced, you may remember this, that the work of destruction is going on with a wonderful rapidity, and that the enemies of life are being slaughtered there millions upon millions, never to appear again in a similar form, though other generations of them may rise up.

As putrefaction seems not to take place without the action of organisms, I had the idea that it might be arrested by an abundant use of air, and I had some belief that the oxidation took place very rapidly after putrefaction. It was when examining this subject that I found it necessary to touch also upon the question of nitration in water. When nitrogenous bodies decompose with an abundance of oxygen, the nitrogen becomes oxidised and nitric acid is formed. I had long suspected that the reverse also took place, and that when there was an excess of putrefactive matter, oxygen was absorbed and even removed from the nitrate, whilst free nitrogen was given off. This process I was able to verify by carrying it on in the laboratory. It was clear, then, and beyond all cavil, that rivers could purify themselves in time, and organic matter be thoroughly removed. It was my belief that organic substances, that germs of disease, that microbes or the smallest organisms themselves were all subjected to this universal and unsparing attack of putrefaction and oxidation. The results, as expressed in my Report of the Rivers Pollution Prevention Act, were in the following terms—(pp. 26 & 27):—

"Putrefaction destroys organic matter without the influence of oxygen; it breaks up organic compounds, and destroys organisms. The evidence seems to indicate that it destroys even those bodies that produce disease, but that in certain conditions it produces others. This is a point not to be enlarged upon without more knowledge, but it is evident that, by putrefaction, we get rid of an enormous amount of offensive matter. Oxygen cannot enter under the surfaces of actively putrefying bodies; but wherever it is allowed to enter by the putrefaction being less active, an action begins which in time completes the de-

struction of the body. We are not, therefore, to suppose that the germs of disease can resist all these efforts of nature to destroy noxious things, nor are we to suppose that an invisible germ of disease can pass on from stage to stage unaffected by the putrefaction of sewage and the action of air. We must believe, for the present, that it is not so. In water we see perfect purification, nitrogen itself being lost.

"In ordinary putrefaction, sulphuretted hydrogen comes off in abundance, with much carbonic acid and some nitrogen. Oxygen resists this action, and if the oxygen is supplied in a concentrated condition a change takes place; nitrogen is evolved as the principal gas, and a decomposition of nitrogen compounds takes place. Nitrogenous bodies are thus destroyed—in one manner by their voluntary putrefaction, in another by oxidation. Up to a certain point, not determined, the greater the amount of nitrogenous bodies, the more rapid is their decomposition.

"The oxygen of the nitrate passes in part to the carbon; some will be retained, forming a carbonate. I have not estimated how much, or if all, is taken by the carbon.

"If the solution is weak, the nitrogen takes up the oxygen, and does not allow it to pass away, thus forming nitrates.

"Putrefaction and oxidation are too well-known modes of destroying organic bodies at ordinary temperatures. The second is not proved to be connected with organisms.

"How far, then, can oxidation, or a great supply of air, be employed to destroy putrefaction or to purify?

"The bearing it has on the analysis of water will be clearly seen by chemists. The bearing on the sewage question is also interesting. Substances and living things may be carried by the rapid sewage system into the range of a new activity before undergoing that putrefaction which breaks them up in proximity to us or in the sewers themselves. It seems to point to a plan of causing the destruction of organisms by putrefaction and subsequent oxidation or by chemical action. At least, it seems to me that we require to learn if it be true that any of the germs of disease, or which germs of disease, will live in an abundance of good air. We know that abundant dilution will render them all ineffective. It is probable that there will be a difference amongst them in this respect, whilst all will yield to the double action of—first, putrefaction, and then oxidation."

Certainly at least this is one of the conditions, and now we may ask what is the character of these changes involved in the word decomposition? I have said the bodies arising from the decomposition may be very numerous; if so, the modes of decomposition must be very numerous, and the term used, viz., putrefaction, cannot represent only one chemical change. There

is one stage of it, however, which seems to be more efficient in breaking up the compounds than any other, and this takes place when the sewage has a certain amount of air allowed to it. How much is not very clear, but there is evidently a limit. Within that limit thorough putrefaction begins, organic substances rapidly disappear, and gases in great abundance come from them—Carbon and Hydrogen, Sulphur and Nitrogen, each in its own way, either in combination as the carbon for example always is, or as bodies perfectly free. It is this grand breaking up of fœtid organic matter which nature has contrived in order to produce purification, otherwise this city would be sending down its river such loads of impurity as even that willing stream would scarcely be able to bear. I wish, therefore, to bring forward now more emphatically the doctrine that putrefaction in a certain stage is one of the greatest of purifiers, and perhaps the most complete that nature has devised. It has often been asked what will become of those many poisonous emanations which arise from the human body even in health, and from those still more dangerous substances which are generated within it during many of those multifarious diseases to which man is subjected. The germ theory of disease has caused alarm in many directions, and it has been imagined that some little germ of disease passing into a sewer or pure river might carry with it power to infect other organisms to such an extent that there was reason to fear for the lives of all inhabitants on its banks. This extreme application of a theory might not be unreasonable were it not that we know from results (at least I think that I may use these words) that no such power exists in any of those germs known to us, when putrefaction and oxidation are abundantly given.

Let us consider the number of polluted liquids which pass from the houses and hospitals of such a city as Glasgow, and the fact that so many of its inhabitants go down to the banks of the Firth, towards which the waters of the Clyde flow, and receive their health and strength for themselves and their families, and we shall see how absurd the ideas have been concerning the power of individual germs, or even multitudes of germs in such situatious.

We may now readily pass on to a subject which has long been important in the eyes of those who have any appreciation of the importance of the attention to public health. It is a subject which presses upon the attention of every town, and it is one which has for many years caused the inhabitants of Glasgow to think seriously, viz., the treatment of sewage. Now I must premise that I do not intend to give you advice regarding the waters of the Clyde. It would, perhaps, be taking advan-

tage unfairly of the circumstances which bring us together, but it has happened that some of my latest work, as indeed some of my earliest, has been upon sewage. There is no subject that can be of greater interest to an institute of this kind, and no city, perhaps, is more interested in the matter than Glasgow. Still I do not come forward with any plan, but, as a Glasgow man, I have been interested in the Clyde, and have examined the water, to some extent, from the Broomielaw to the deep sea many years ago. Lately (that is, about three years ago) I dredged a good deal of the Clyde, and examined the mud, simply for my own satisfaction, having had the advantage of the use of the steam yacht and dredge of Mr. Duncan, of Benmore, who himself superintended the work. Having been appointed inspector under the Rivers Pollution Prevention Act, I have been led to reconsider the whole subject of foul water and pure water, and I was requested by the President of the Local Government Board, Mr. Sclater-Booth, to examine the results of the treatment of sewage by various methods in England, so that I was led to the reconsideration of sewage without any reference to the conditions of Glasgow; and I may add here, what those who have studied the subject will readily believe, that he is not a wise man who will venture to be very dogmatic in making out plans. It is, however, at all times a pleasant thing to add to our knowledge, and for this reason I have thought that some time spent upon this department would be of advantage to myself and perhaps to others—procuring some information which might serve in attaining ultimate results.

It is remarkable how rapidly sewage enters into putrefaction, and to know the results of this putrefaction has been a considerable difficulty. The emanations from sewers have been found guilty of producing a peculiar form of fever, very well known to medical men in some of its stages, and apparently so definite that it may be considered as ranking with one of the chemical tests in its strictness. The gases and vapours which come from it are the results of the decomposition of organic matter, and the number of compounds into which the material of animals may be broken up is so varied that at present it may be said to be entirely beyond our ken. These compounds vary in character to such a degree that they may form the most innocent gases, the most wholesome food, or the most virulent poisons, venomous substances that destroy entirely vital functions of the human body in a scarcely appreciable time. Some of these obnoxious bodies arise from the decomposition of sewage, and, as already said, seem to be formed at some particular proportion of the supply of air.

It is easy to see that it is a mistake to suppose that by send-

ing putrefying liquids down to lands we are giving these lands all the sustenence which the sewage originally contained. If we wish to use them as sewage it is better to use them before putrefaction, the loss by putrefaction being great. I suppose we can scarcely doubt that putrefaction takes place more rapidly when the organic matters are diluted to a very considerable extent with water. Having made many experiments in order to find the condition of the air found lying over somewhat solid putrid substances compared with the same substances very diluted with water it was found that the greatest amount of ammonia, and the most offensive odours were from the more solid. This is quite in accordance with the explanation given of the more complete disruption of the organic matter in water, and it was these experiments that led me first to think of driving the air through sewage matter in order to produce oxidation, expecting readily to form nitrates, and in the belief also that excess of air would be offensive to the microzymes, although a small amount seemed necessary for their activity.

The most complete experiments on aëration which I was able to perform were done by the apparatus of Dr. Storer and Mr. Cranston. The Messrs. Storer were good enough to put at my service two of their revolving screws, which are used to agitate the water, to draw down air into the centre, and to send it out at the circumference of the vessel. For this purpose they put also up in my laboratory a gas engine, to drive these screws, and I was thus provided with very efficient apparatus, for which I cannot sufficiently thank them. The result of the aëration of sewage, and of other liquids containing organic matter to a similar extent, was, that, in all cases, putrefaction was delayed by aëration. The dissolved oxygen also recovers itself in the aërated specimens better than in the non-aërated. This shows that aëration not only prevents putrefaction, but prevents also the chemical action consequent upon it. It had, in fact, to a large extent, and for a considerable time, rendered the organic matter inert, or nearly so. Nitrates are formed also more readily in the aërated than in the non-aërated specimens.

There are some curious peculiarities connected with the formation and disappearance of nitrates, but with these details I shall not trouble you. It was in looking for nitrates and measuring the amount of ammonia in the aërated and non-aërated solutions, that I observed how much the ammonia diminished in amount, and sometimes the air passing out from the water contained a strong smell of ammonia. In working with the apparatus described, a constant loss of ammonia was observed. The sewage was tossed about, the volatile matter was carried up with the currents of air, and had no opportunity of returning.

"It is well known that to obtain the ammonia from sewage has been the aim of chemists for many years; and to make use of it in some form or other, without extracting it, has been the study of many engineers. The amount of ammonia, as we have long known, is great in sewage, but we have not known how to remove it. The amount, however great in the bulk, is small indeed in proportion to the amount of water, being from four to seven grains, very often but not more, in a gallon of 70,000 grains. The loss of ammonia, when using the apparatus described, suggested at once a method of obtaining a revenue from sewage."

Work of a similar kind had been done by Monsieur Lauth, and published in the "Comptes Rendus," where the following is stated:—

Paris Sewage. By Ch. LAUTH (Compt. Rendus, 84, 617–620).—Two vessels, one containing ordinary sewage, the other sewage saturated with air, were placed aside, to watch the effect. The former soon became black and offensive, whilst the second, after two months, was still inodorous. The chemical action of the aëration was as follows:—

	Insol. N.	Sol. N.	N. as Nitric Acid.	N. as Ammonia.	Total N. by vol.
Before aëration	14·70	20·65	1·176	8·4	38
After „	8·05	26·95	1·122	14·0	38

The effect of lime on the sewage was next tried; it remained inodorous and colourless after two months, and gave on analysis the following results:—

	Insol. N.	Sol. N.	Nitric Acid.	Ammonia.
Without treatment.....	14·70	20·65	1·17	8·4
Treated with lime	10·15	25·55	2·60	18·20
Treated with lime and aërated...	6·65	28·87	2·12	21·35

These results show that the development of putrefaction producing sulphuretted hydrogen may be avoided, not only by treating sewage with lime, but by mere aëration.—*Taken from the "Chemical News."*

It will be seen that the results obtained are far greater than those obtained by me, and the product increase of ammonia by putrefaction is remarkably so. Could he obtain such results in our sewage I think I could scarcely doubt the possibility of profitable working; but probably the material itself, and the temperature of the country, may explain its most important differences.

If we could take only one grain of ammonia out of one gallon of sewage we should have from 1,000,000 gallons 1,000,000 grains = 142·8 lbs., or 140 lbs. Let us suppose that there are in Glasgow flowing from the sewers daily 50,000,000 gallons, and we should have 7,000 lbs. of ammonia daily, this would give us in a year above 1,100 tons which might be put down as somewhere nearly £60,000 in value. But can we obtain one grain out of every gallon? In the laboratory with a small apparatus this has not always been the case, but if lime is added to the solution the ammonia comes off more freely, and experiments have been

made in which about two grains per gallon were obtained. In one experiment made in Glasgow with one hour of aëration two grains per gallon were obtained without lime, but this was in a very strong sewage containing nine grains of ammonia per gallon. Sanitarians are very glad to hear of great sums of money being obtained by processes which tend to health, and in order to please them with a certain vision of glory we may draw out the calculation on the supposition that all the ammonia was obtained. Let us take only a moderate sewage containing only six grains ammonia per gallon and we should have an amount of ammonia produced per annum equal to £360,000. But is this within our grasp? The ammonia is removed from the liquid, but it is carried away in enormous volumes of air, and from these volumes it must be extracted. I think this may be done, but I shall not dwell upon it. You may suppose I was very much pleased in obtaining even some slight hope of the solution of the great question. We sometimes expect a little credit for doing any useful work or even making a step in advance, but when writing the account out and making some inquiries I found that instead of deserving credit for my labour I deserved only blame for my ignorance. It was found that the idea had come into the mind of another ten years before, and had been thrown away.

A provisional specification had been made out in 1870. The first projector seemed to have lost confidence in his principle, but another patent was taken out by Messrs. Hills and Biggs in 1872 for a similar purpose, one by Messrs. Welch and Scott in 1876, and one by W. L. Wise in 1878.

I can only, therefore, give my version of the subject; still, I think it is a useful one, and I published it in my report to the Local Government Board on the Prevention of the Pollution in Rivers, so that others might make the next step, and have given details not elsewhere given, so far as I know. In the passage of air through water the gases are removed and some volatile substances, whilst the air, being greater in volume, takes their place. The volume of air is a decided objection in working this process. I was desirous of diminishing this, and therefore resorted to the air pump, and tried if it were possible to exhaust the water of its dissolved gases.

This may be done to a large extent by pumping them out; and it is remarkable how much is done, at least on a small scale, in a minute or two. I cannot say that a result has been obtained equal to that by a current of air; and we must remember that the current acts oxidizingly as well as by displacement, but a great deal is effected by the exhaustion methods. The gases come off strongly impregnated with organic matter. They may

in this case be sent through a disinfecting process if the ammonia cannot be got out. It was expected that by taking them out in a concentrated state they could be passed through acid, and the ammonia removed in a small absorbing space, thereby getting over the difficulties which may be expected when we try to absorb the ammonia from a large amount of air. This, however, was not found in practice to take place to a sufficient extent. Very little ammonia was removed by pumping.

At the same time it is very probable that the failure was not inherent to the process, but caused by the limited and imperfect scale of laboratory operation. In some cases it is probable that ammonia would come off in this way (that is when the sewage was stronger than usual). I should be inclined now to expunge the words "imperfect scale of laboratory operation." Still I looked to the air pump as a valuable addition to the aëration, or rather as a preliminary to it. As I mentioned, "if this method of pumping out the gases were adopted, it would only be a preliminary to aëration, which might be affected either by allowing the air to enter, or by assisting it."

It has happened that I have found it convenient to bring before you a subject which certainly is very interesting to Glasgow; and I now wish to bring to your mind the name of a man who certainly I incline to think, of all men in his generation, had most influence in Scotland, by creating almost single-handed one of the largest branches of trade, and being influential in causing his work to be imitated over large portions of the world. I speak of Dr. James Young, who has only of late left us. Dr. Young, however, requires little of my recommendation. I may almost say that he found the cottages of our country in darkness during at least half the time of active life, and he lighted up the winter nights and mornings for them to such an extent, that life became doubly valuable and labour more profitable. It is difficult to imagine how miserable life is in a house where the inmates cannot afford light from four o'clock in the afternoon till ten o'clock at night, and from five a.m. until eight, and when people must go to bed and sleep from mere dreariness and listlessness: it is a frightful loss of human life and happiness. I know from sufficient observation in places where darkness enveloped the people in the hours mentioned, light, and a brilliant light too, has taken its place, and I have observed the difference with pleasure and astonishment.

Scotland cannot forget James Young, and Glasgow will remember his name and his gratitude, as he has shown the latter by planting the "Young Laboratory" on the scene of his early studies and by placing in St. George's Square a

statue of his distinguished teacher, Thomas Graham, also a native of Glasgow. As Dr. Young was to me an old and intimate friend, it was natural that I should speak to him of my work on water; but at this time he was very feeble, living at Kelly, but unable to walk about its grounds, glad, however, to look out and see the varied scene before him, and always glad of a visit from his old friends. He was extremely interested in the results, and after thinking about them, told me that he had an improved method for the treatment of sewage, as mine would be too expensive. The latter part I was willing to believe, because, as already said, I brought it forward more as a scientific study than a practical process. It was long before I knew what his ideas were, for he seldom gave his thoughts out rapidly, even to one who was so long intimate with him as I was. After some time I found from him the following:—

His experiments shewed that strong ammonia liquor lost ammonia, until the amount remaining was only 1 in 210,000, whilst weaker solutions became concentrated until they reached that point, and his idea was to boil off the ammonia. This seems certainly a very bold thing. It was found that by distilling 5 per cent. of the sewage at 212°, the bulk of the ammonia was contained in the distillate. By increasing temperature and pressure it still increased, whilst at 70lbs. pressure almost the whole of the ammonia could be obtained by distilling over 1½ per cent. of the liquid, the expulsion of the ammonia being also facilitated by the injection of a small quantity of air. Dr. Young's idea at this time was to distil off ammonia at a high temperature and pressure, so as to obtain a concentrated ammoniacal distillate, and afterwards to recover the heat by passing the exhausted liquid through a series of pipes surrounded by cold sewage, to be heated to the boiling point in turn, thus making heat a part of the working plant; but on enquiry it was discovered that to cool a quantity of liquor from 280° F.=(138° C.) to 60 F.=(14°.5 C.), by raising an equal quantity of liquid from the lower point to the higher, such a great conducting space would be required as to make any such process quite impracticable on such an extensive scale.

It was found that a low temperature became one of the primary conditions of success. He found that, by using an exhausting air-pump and raising the temperature to about 80° F.=(26°.6 C.) only, sewage which contained five grains of ammonia per gallon was almost entirely deprived of it in a few minutes. This is the central experiment upon which his process is founded. I do not purpose, however, to give the various details of the work as it was carried on, with great perseverance, during his last illness, as one may say.

In other words, he found that, instead of passing air through the sewage, it was sufficient to pass steam at a very low tension, and, consequently, with an enormous bulk. This did the work of the air, and the ammonia was absorbed from it instantaneously by acid. It is difficult to know from smaller experiments what may be done on the large scale for the sewage of a great city; but it may be mentioned, as a result obtained by Dr. Young, that when he passed the sewage down a coke-filled tower, which was rendered vacuous, and which gave, from a great expansion of surface, a ready means of evaporation, he considered that he had put the problem in a satisfactory form. From a tower, or cylinder, 5 ft. 6 in. high, 5 in. in diameter, filled with irregular pieces of coke, about 4 in. cub. sewage was exhausted, of 80 per cent. of its ammonia, at the rate of 5 litres per minute, and with a distillate of 1 part ammonia in 1,200 liquid. Taking this result as a standard of calculation, it was believed to demonstrate that the process was theoretically capable of extracting ammonia from sewage on a commercial scale, and that any practical difficulties ought not to be beyond the powers of chemical engineers to surmount. It was believed that addition to the height of the tower would enable the steam to be charged with ammonia to 1 in 800, while increased pumping and condensing power would lower the working temperature to 70°=(21°·1 C.) or less. The vacuum used in this experiment was equal to ½ inch, or 12·7 mm. of mercury. It was believed that the temperature of 70°=(21°·1 C.) was one which could be obtained on a large scale, perhaps at all times, whilst at other times it may be said to be the temperature of the sewage.

I cannot forbear remarking here on the boldness of this conception of Dr. Young's. Perhaps some of his assistants will write out fully the details of his work as they were obtained with a care which never ceased as long as he had strength. One never knows what may be the end of any careful enquiry, and I do not presume to give a very decided opinion on this subject, but I incline to think that for some strong specimens of sewage this plan may be found both practical and profitable. Though Dr. Young fully believed that his idea of the steam was perfectly novel it cannot be asserted that it was so. It is exceedingly difficult to obtain ideas which none of the great multitude of mankind that have gone before us ever perceived. But I believe that amongst the papers left by Dr. Young there are extensions of the idea sufficient to shew that he had mastered the whole thoroughly, made advances, and explained the matter better than had previously been done. Many of these points I have not had an opportunity of examining carefully, I suppose

they will be brought into order by the work of his successors; and I hope that engineers and others directly interested in such matters will not allow the promising results to pass away without leaving benefits behind.

It is probable that I have said enough concerning sewage, and have become too technical for most of my audience, and others may think that I have rather defended the pollution of the Clyde, and shewn it to be a reservoir of purification. I certainly believe that it is so to the extent explained by me; but do not suppose I can ever imagine that the remaining conditions so palpable to the senses, and so evidently injurious to those immediately connected with it can have any defence from me. My knowledge does not permit me to give an opinion on the general effect on the health of the town. I trust, however, that I have said something that will encourage thought and action on the very important problem which is before you, and before many other cities in a similar situation.

It was not my intention to say so much about sewage. The subject which I mainly intended to bring before you was that of oxidation. This is a very old problem for chemists, and every beginner must learn the strange effects produced by this wonderful gas—oxygen. We must still think as beginners, and go back to our earliest thoughts in the science. Some physiologists tell us that our life is a mere product of oxidation, that even our death is a result of the more violent attack made on us by the same gas. It would seem, therefore, as if this wonderful agent had the remarkable power of blowing hot and cold, of producing strength and weakness, being our greatest friend and an enemy from which we cannot escape. No wonder, then, if we give it many contradictory duties to perform. It was always known that pure air had a cleansing power, and it has long been known that oxygen was the main agent there, and I have already spoken of the value of wind blowing through a house to render it pure; but it has somehow happened that its rapidity of purification has never been brought so clearly to my mind as by these experiments on the purification of sewage.

The act of purification is to be seen here rapidly. It is not the work of days or weeks, but the work of minutes, and the belief is taken out of the region of reasoning into that of the simplest observation. It might seem rather absurd to attempt to prove this; nevertheless, there may be many minds to whom this proof may be useful, since it has been useful to myself, who may claim more familiarity with the subject than is common to the generality. It brings us, also, to that point which may be said to be the central point in all sanitary reforms, viz., the

importance of pure air. There are many other points, but this I incline to hold as the first. Its importance has been recognised in a magnificent manner in this city, and I might almost fancy that I hear the authorities say that on this subject, at least so far as regards our streets, you do not require to speak to the people of Glasgow, seeing how much they have done towards tearing down old buildings incapable of giving wholesome shelter, and destroying the narrow courts and lanes, which have the power of producing misery to a population already sufficiently oppressed. Much has been done, and I do not doubt that the public authorities are sufficiently acquainted with their duties, but there are still many people to teach, and, I fear, a large population unwilling to be taught. I should be better pleased if I could see in the reports of Dr. Russell, your distinguished Officer of Health, that the number of houses with the lowest number of apartments was not so great as it is.

I still consider that it often happens that in entering houses in Glasgow there is a feeling that the air might pass more abundantly through them. The reason of this may be perhaps the climate, and the artificial conditions of a town, making it inconvenient or unpleasant to keep windows long open. Or does some of this arise from a condition of things for which Scotland has been blamed — a want of sufficient cleanliness of the interiors? I hope this complaint against Scotland is being thoroughly removed; my belief is that it is being greatly removed. In country places perhaps the evil, so far as private houses are concerned, has a more lasting residence, and even in the midst of abundant draughts of the sweetest air people are found to be living subjected in dark and unclean corners to the dangers arising from putrefaction and decay. I often wonder at this among the farmers of Scotland, who must have learnt surely, as they are not without reading, the value of those substances which they allow to pass away, although more suited perhaps in some respects for the land than the artificial manures which they buy.

A learned Professor, just come from the Continent, called on me the other day and spoke of the wonderful instinct of washing which seemed to pervade the households of Holland; he had observed one woman washing down the outside of her house, and another washing the trunk of a tree which stood opposite her. The very boys seemed to enjoy themselves by picking out weeds. And he asked me then the question—Does this extreme of cleanliness conduce towards longer life? Can we say to any man, wash and be clean and you will live longer? Yes; but the question is an extremely complicated one, as all questions regarding natural phenomena are. Cleanliness is wholesome,

and I believe that those who are clean will live longer than those who live in filth. But there are some curious anomalies regarding this nevertheless: we do not hear of the longest lives, those above 100 years, being found in that class of society which is most attentive to cleanliness. It seems rather in the opposite direction. I have found it interesting for some time, on receiving the Quarterly Returns of Births and Deaths, to observe the number of persons who die at very advanced ages in Ireland. These persons do not belong to the higher but to the lower classes.

In this country also it seems to be the case that it is in the lowest class, in classes where cleanliness is least cared for, where these extreme cases occur. There are people who simply solve the question by denying the extreme age. I have not seen the propriety of questioning these higher ages to such an extent as some have done, any more than those ages which are lower; and I feel rather inclined to attempt the solution instead of resorting to a course so old fashioned and easy as that of Alexander the Great, viz., cutting the Gordian knot by denial. At the same time I do not deny that enquiries made on this subject with a desire to obtain the truth, have been very valuable, and have abundantly proved that gross exaggerations have been made, and that care is absolutely necessary. Although I think a good deal in Ireland is due to tenacity in the race, which gives the people a lightness and a vigour even in very trying circumstances, the results seem only explicable by supposing that those who have lived so long in conditions so unfavourable to health, have been deprived of that sensitiveness of body and mind which in one case would have raised them above the lower levels, and in the other have made them more liable to give way to the wear and tear of life.

The same Professor told me that amongst the scattered cottages of the country there was much poverty, but cleanliness everywhere was remarkable. There was a time when many of the Scotch students went to finish their education in Holland, but it was not a time for ladies' colleges there or here, or we might by this time have been rivals with Holland in all the arts of purification.

But now we must return to think more closely on the action of oxygen. If the oxygen is found to diminish the activity of those minute moving particles which form or produce a disease called chicken cholera as Pasteur has shown, and if oxygen also puts an end to the decomposition in sewage in a manner rapid and decided so that decomposition will not begin again for some two or three weeks, according to the weather, we may ask how far it may be used directly in the destruction or weakening of

microbes in other situations. When Dr. Koch found Bacilli peculiar to consumptive patients and existing in their lungs, it was natural for me to ask him whether some excess of oxygen might not prevent their growth, as I found a similar result in sewage. However, it was a question more easily put than answered, and I suppose we must leave it. We get here into a number of difficulties which can only be solved by careful observation, and I do not know yet how far we are to understand what is the tenacity of life of various forms of microbes in various gases. It is clear that experiments relating to the existence of life in particular gases are not sufficient for us, because, as Pasteur shows, although the germs may live, they have in certain conditions, if not entirely, lost their power of giving disease, or, as he says, become attenuated. Here we have a large field before us, and it is to the attenuation or destruction of these forms of life that microscopists and physiologists must now attend. In the long discussions, and somewhat bitter ones, that have taken place regarding vaccination, I do not know that any one has attempted to act upon the agents in a manner suggested in the case of chicken cholera. I am not a medical man, and must speak of these things only as a chemist; but it seemed to me natural to think that if some modification of the matter of small-pox could be obtained by oxidation, another step would be to attain that modification in a still greater form upon the bodies of the patients. As we have seen that oxygen is the great purifier in the regions of the air over the great oceans and in them, and is working even in the soil in our towns, and in our houses amongst our furniture, and upon ourselves within and without, and that it so rapidly removes that disagreeable matter of our town sewage, let it be compelled to purify even disease itself when it has attacked the human body. This is only an extension of the great idea of sanitarians that pure air is wanted all around us, and that by pure air we can obtain one of the first steps to health, although there may be cases where even this idea must be modified.

It is interesting to consider the cause and the production of zymotic diseases according to the various views which mankind have had. The angel of death has always been sure in his work, but his work has been unseen unless the darts of Apollo which caused the plague in the Grecian army were the well-seen beams of the sun acting on masses ready to decay. Now the agent is believed to be armies of numberless living particles, one may almost say, totally invisible to the naked eye and known to a few only who use the microscope. Whence do these armies come, and how are they fed? If they are formed readily out of the substance of the person whom they attack

they do as other armies do, feed upon the plunder taken from the enemy. But if so why do they ever cease as long as food for them remains? There surely must be some limit to their capacity of growth, otherwise destruction to the attacked would always follow. I do not know if I have read sufficiently on this point to know the general opinions, if indeed there are any; it may be that there is formed within men and other animals a certain amount of material from which Bacilli may feed even in healthy bodies. It may be that this material may be more in some persons than others, and it is just possible that this may be removed by certain agents, one of them being the oxygen or pure air which I wish you to think of, and by the various exercises and changes of place which enables the oxygen to be more active within us.

Still there are other things to be thought of, and surely these little Bacilli which have been mentioned are under some other command, and they themselves may have a general whom they learn to obey. If their growth depends merely on the food supply, then we are brought to chemical agency affecting their increase or decrease, and this agency in a limited sphere, but their lives may be regulated by other movements, some on the earth and some in the stars. The sun's direct rays must affect them as it does all things around us, and its indirect action when it sends out magnetic currents that bring the earth in constant and varying sympathy may also influence the lives of the minutest creatures, as they no doubt influence the still less observable chemical action.

There was once a considerable discussion as to the part played by organic life in fermentation and putrefaction; and Liebig took up the chemical idea and objected to the belief that microzymes were necessary for chemical work. He lost, apparently, the day; but under the life of the microzyme chemistry and physics are at work, and how they manage to produce the result is still a problem to us. We must not suppose that when chemical action is not violent, as it sometimes is, that it is entirely absent. If we take a liquid containing a strong solution of a crystalizable salt, and add a minute crystal to it, how readily the whole mass takes the form of this crystal; and yet how weak, apparently, is the first, and how slight the connection between the two, whether chemical or physical, or both. This leads us to think that the various powers of creation are by no means inert in the production and the continuance of disease; and the lower we go in the scale of animal life more likely are we to meet with causes acting in a manner more allied to those of the inanimate world, but still affecting the lower and, through them, the higher organisms. This would bring us to think of changes caused by the

conditions, both of the earth and of the air, and naturally show why this section should point to meteorology and geology.

Before leaving this subject I am inclined to refer to some speculations which were printed in 1848, and which seem now to be reviving in other minds. So early as 1848 I had come to the conclusion that, "permanent chemical compounds, gases or liquids, are not capable of acting as infectious or contagious matter, that is, cannot convey disease." I may add, also, some sentences from the same paper, printed by the first Board of Health.

"When fermentation has ceased, that is, when the materials on which fermentation acts are worked up, and their action begins under favouring circumstances:—When, for example, alcohol is formed to the utmost extent, the next substance is entirely different—vinegar appears; this induces another action, so that the cessation of one fermentation supplies the conditions for the commencement of another."

"If a pestilence were caused by the condition of the air generally, it would go with the wind, it would not take seventeen years to go round Asia, Europe, and America. It would act as constantly as the changes of the weather, that is, in many places at the same time, but it takes leaps, not very long, and acts fitfully and freakishly. Human beings are not the only conveyancers, but filth, that is, fermentable matter is, it is conveyed along all places, giving out effluvia, but the effluvia of filthy places did not produce cholera till the disease came near us from Asia. Organic matter may be called the conveyancer of cholera, that which takes cholera itself and conveys it to others."

"At the same time this shows us why clothes should be considered dangerous; not porous materials but organic materials, which are capable of taking the disease, whether from the amount of organic effluvia given out by the substance, or by the amount of matter which they retain from the body, may be a question. That is, whether the substance itself of clothes, or the person wearing them, be capable of taking pestilence or both. Moses mentions the fact of clothes and skins taking leprosy.

"This"—that is, the reasoning—"explains why other diseases should disappear when cholera and plague come. The one fermentation sets all the others in the same course, and absorbs the action of organic matter in the air. It is a matter of curious enquiry, this one power putting down all the other powers. New fermentations arise; when one is doing its work it produces entirely new conditions; where it works, these new conditions rouse new actions, and it seems, in the complexity of organic nature, as if the power of producing novelties were

increased by the number produced. Man, capable of one disease to-day, is capable of another to-morrow."

And in 1852 I used similar words:

"In this way various ferments would produce various substances, or a substance putrified might go into plague fever or small-pox, just as parts of the body do. Filth, therefore, is a conveyance of disease, taking the lead of any infection that happens to have the reins in its hands at the time. No wonder, then, if all diseases disappear before a great disease, one great ferment banishing the others. There cannot in one liquid be the mucous acetic and alcoholic fermentation at once. But they may come in succession. So, after one disease, another may arise on its remains. Is this the explanation of the rise of new diseases, on the history of the progress of some we knew, which go on from stage to stage?"

The action of weather upon health is one of the important points included in meteorology, and some people may suppose this to be the only point; but I think that although the complicated changes that occur giving various proportions of heat, of light, of wind, and of rain have an enormous effect upon us, and, as Mr. Baxendell has shown, are the greatest agents in producing rapid changes in the mortality of the country, there is still much to do in the examination of the constituents of the atmosphere, especially those minute bodies and agencies which are less under our observation. I should have been glad had I been able to say that the habit of the chemical examination of the air had taken deeper root in this country, and attached itself to establishments for meteorological study. I spent some years upon this, but hoped that it would be continued by others.

I have indicated here one simple method of observing ammonia as an indication of organic matter, and published after my book on Air and Rain. And I should like to call attention to another point, viz., the measurement of the light; and to bring this in as one of the phenomena which may receive constant attention, because it affects the health both of man, of animals, and of plants. There has been an attempt amongst meteorologists to give the amount of cloud day by day, observations, which are very imperfect, there is, however, a better attempt, and a more successful one, to give the amount of sunlight direct, and that is to be much admired. I have endeavoured to bring forward a mode for measuring total light, whether sunlight or otherwise, it was founded on a chemical decomposition of iodide of potassium, first observed by Dr. Leeds, of Philadelphia, but applied by me to find out the comparative light of town and of the adjacent country. The differences

were found to be very great. I hope that experiments, such as these, which I have published, will be attached to observatories. I feel sure that if they be continued for some years they would enable us to account for much which is at present perfectly dark. I have applied the same reaction to the estimation of the brilliancy of water. Although I cannot say that brilliancy is an absolute test of purity of water, it is at least an important characteristic.

In this country we should come badly off indeed if we depended for our vitality on direct sunshine, and I consider it much more important to obtain the total luminosity under which we are compelled to live, whether the sun's rays are direct or not; however gloomy our climate may be, and at times depressing to the spirits, the darkness does not seem to exist amongst us to such an extent as to prevent this country from being one of the healthiest in the world.

The effect of meteorological conditions as affecting disease in many of its stages, or, as we may say, affecting health, has been examined so well by Mr. Alexander Buchan and Dr. Arthur Mitchell that he will be a very diligent student indeed, and a very fortunate man who advances before them in such knowledge, although, I suppose, some day even this must be done.

It does not seem at all probable that we shall, at any time, be able to affect, in any substantial way, meteorological conditions, but this is rather hastily expressed: we have, unquestionably, altered the climate of a large portion of England. Drainage has removed many sorrows from the population—fever, ague, rheumatism, and the various affections which we put usually under the word cold. How much these surface changes, which may be called geological, have affected the atmosphere, so as to alter the rain-fall, may not be so clear. Interesting data, however, have been collected by Mr. Alfred Fryer of late years, showing that the effect in some cases has been considerable.

We can sometimes affect meteorological influences by the use of cannon-balls, shooting our enemies in the air, as we shoot other enemies, for instance, in the case of the waterspout, or by the use of explosions, set the atmosphere shivering until it can no longer contain its rain. Shall we ever be able to influence the greater storms of the world, those, for instance, that come and sweep over the continent of Europe? There may be a place where, like other things, storms begin in infancy, and like other infants, they may have very tender lives, which, in their case, it would not be wicked to destroy.

One can scarcely avoid at this time pointing to geological

phenomena as deeply affecting human life. In our own lifetime we have heard of violent changes in certain parts of the world, and only last month of some of the most frightful occurrences to which nature has ever subjected any known portion of land. Such changes must affect the health of those who survive the catastrophe, such as that in Java, because of the change of surface, and the destruction of the usual healthy condition of the soil, as well as the interruption to the usual supply of food.

But the condition of the surface of the ground and the influence of the violent phenomena are subjects of themselves too interesting to be spoken of in a fragmentary manner, although the second of these may happily have little interest for us who live in a country where the minutest vibrations only are observed in its foundations. The first of these, viz., the condition of the surface, is one that can never cease to deserve our attention, as its preservation, with its due amount of heat and of moisture, must always be to us of the greatest importance. (Much interesting matter on this subject will be found in Hecker's "Epidemics of the Middle Ages.") I shall finish by remarking only that we have still much to learn regarding the effect of surface on the air, and I hope that some papers will be read on this, bringing us up to the latest period, since a good deal of attention has been given to it, but I cannot here bring forward the work done in Germany and in America, having been compelled to go for a holiday at a time when in ordinary cases I would have been laboriously collecting from all sources matter for your instruction and entertainment. I have more matter in hand, but I trust that for the present I have brought forward subjects enough, although, in a fresher state of health, I might have attempted to press more on your attention.

There is, however, one subject on which I have promised to say something—it is smoke. I might have given all the time to it, but I shall only repeat what I have said in late reports, that the new modes of treating coal point to a time when the products will be so valuable that the heat may be considered as a waste product, and smoke absurdly extravagant. People take these ideas too slowly—men wait and wait; and they will consider how to save coal when it is done, and how to preserve health when they are dying. Even places to which you resort for health are defiled by the blackest smoke. Can you not show a preference for steamboats which have some care for appearance and comfort in this respect, if such steamboats are to be found. Perhaps the newest ideas are less applicable on sea, at any rate much may be done there; and on land I hope

that manufacturers will not neglect new ideas, lest they find too late that trade has left them.

Sir JAMES WATSON proposed a vote of thanks to Dr. Smith for his interesting and important address. Dr. Smith, he said, had devoted a long lifetime to the elucidation of these important questions, and he had made very great discoveries in many of them—discoveries which had been of great importance to science. Much credit was due to him for what he had done in regard to the ventilation of mines. His information to the Home Secretary and the Local Board was of such a description that it was carried into effect, and had been the means of saving many valuable lives. He believed they were much indebted to Dr. Smith also for the knowledge that they had of the atmosphere, and its connection with health or disease. The lecturer had done much in the cause of science, and consequently the opinions which he had given them in the lecture that morning were of the very greatest importance, and deserved their most serious consideration. Dr. Smith's remarks upon oxidation in the prevention of disease and in the promotion of health were such as were worthy of being considered, and should be put into effect by every person. He thought they should all use their influence as much as possible to promote it among their friends and especially among the working classes. These observations were very valuable in a town like Glasgow, where there was a considerable amount of population who were not without the need of hints upon the subject. When he was connected with carrying out the Improvement Trust in Glasgow one difficulty he had to contend with was not only the closing of windows, but the objection of the people to go into better houses. There had been a very great improvement in Glasgow in this respect. He thought Dr. Smith's remarks in regard to the purification of rivers were well deserving of the attention of our local authorities. There would be great difficulty in meeting the enormous expenses which they would incur were they to follow out any of the proposals that had been made by the engineers hitherto. Probably a couple of millions would be required before it could be effected. Experiments were now, however, being carried on which he hoped would have the effect of showing them the mode which should be adopted. Dr. Smith's remarks upon smoke were most valuable. If he were correct that the value of smoke will be such as to induce every consumer to change their present mode and abolish open grates, he was sure it would be the greatest blessing which they could obtain. Every manufacturing town was polluted with it, and in Glasgow it was becoming every day more and more a subject of annoyance—to such an extent that the people in Glasgow were actually going to the outskirts of the town to avoid the smoke as well as the rates. Any improvement in this direction would be of the very greatest impor-

tance to Glasgow and every other manufacturing town throughout the kingdom.

Dr. CAMERON, M.P., Glasgow, seconded the motion. He hoped that if Dr. Smith did take the smoke nuisance in hand he would not confine himself to Glasgow, but go into the surrounding districts, and apply his sensitive nose to the abominably fœtid smokes which were to be seen rising on every side from bins of burning shale and other refuse, and try if he could do something to render life in the country immediately surrounding Glasgow at least as tolerable as it was in the town. The address which had been read by Dr. Smith was particularly valuable at the present time, when the relations between chemistry and sanitation were undergoing a very considerable change. The purely chemical school of Liebig, which pointed out the importance of pure air and pure water as well as it possibly could be pointed out, had given way to a large extent to the zymotic and vital school of Pasteur. So long ago as 1848, Dr. Smith suspected that not to impure gases alone were they to attribute outbreaks of disease. He was glad to see that although in this country the vital philosophy, as regards disease and sanitation, of Pasteur had not made such great way as it had done on the other side of the Channel, yet very important contributions had been made to it by two men in this country. One of these contributions was that of Professor Tyndall, who had done most important service in the vital analysis of air; and the other service to which he referred was that of Dr. Angus Smith, who had invented a process for the vital analysis of water, which he thought they might look upon as a fresh starting point to sanitarians in their search for a test of pure water.

The CHAIRMAN, in conveying the vote of thanks to Dr. Smith, referred specially to what he had said as to the utilisation of sewage. He himself had for many years been interested in that subject. He had seen, and did see, the sewage of a population of 80,000 utilised with the best results. Land which before it was so utilised was worth 25s. per acre was now giving a much larger return. Land had been purchased by the Local Board under whom it was worked at a cost of £180,000. The interest upon that money was being paid. The land itself, which formerly would only bear one ox or half an ox per acre, was now bearing food for 3½ oxen per acre, and food was being provided for the people, and abundance of milk was being sent from the farm for the use of the people. Again, before the farm came into operation, there was only one person occupied for every 50 acres, whereas now occupation was provided for one person on every four or five acres. There was therefore abundance of employment, and a very large production of animal food for the people, and there was a large amount of money paid to the original owners, who had been made rich men, while the sewage of the district had been entirely utilised at very moderate expense to the district. He contended that a town had no right to discharge and to destroy that large amount of ammonia spoken of by the lecturer, and if it were so they

were doing their country a very serious injury, for which they ought undoubtedly to be called to account. Until they took care to keep at home for their own purposes at least a large amount of the ammonia that had been referred to, they would not be doing their duty as citizens. On the part of the audience, and on his own, he had to convey to Dr. Angus Smith a hearty vote of thanks for the paper he had read.

Dr. ANGUS SMITH, in acknowledging the compliment, said he was afraid that Dr. Cameron, in his extreme courtesy, had given him credit for some things which must be referred to others. He certainly was working upon the analysis of water, and thought he had found some things which he believed were new; but he was afraid lest Dr. Koch should imagine that he (Dr. Smith) claimed the gelatine process, and, therefore, he was anxious to say that Dr. Koch had the entire credit of having begun the use of gelatine in this department.

On "The comparative merits of Fine and Coarse Flour as articles of Food," by WILLIAM WALLACE, Ph.D., F.R.S.E., F.C.S., F.I.C.

HAVING occasion to visit frequently one of the lowest quarters of this city, I have often been struck with the very large proportion of children in this locality who are "ricketty," or have their bones deformed from the absence of a sufficient proportion of phosphate of lime to give them stability; and although this is perhaps rather a medical than a chemical question, I venture to introduce it to the members of this Congress in the hope that some good may result, if not from the paper itself, at least from the discussion to which I trust it will give rise.

I am well aware that the disease popularly called rickets is not confined to any part of this city, nor to any particular city or town, altough it appears to be more prevalent in certain localities than in others. It is found wherever children are brought up on deficient diet; in crowded, ill-ventilated apartments; in streets in which the air is more or less tainted, and in which the sun is seldom seen, where there is no ground for exercise but the dirty street; in short, where all that is pure, all that is beautiful, all that is requisite for the healthy growth of the soul as well as the body is banished. It is a disease that is rarely met with in the children of the upper and middle classes, or those of the poor who are brought up under more favourable sanitary conditions than those I have mentioned.

The healthiest children, and the most robust men and women, are those living in agricultural districts, who, though eating the coarsest of food and enjoying the fewest of the luxuries of life, have a pure atmosphere to breathe, plenty of sunlight, and free exercise for their limbs from the moment they are able to crawl out of the open cottage door. Now I cannot for a moment doubt that the general insanitary conditions of life of the city child have a most powerful influence in bringing about the development of this melancholy disease, which always results in a greater or less degree of deformity of the lower limbs; yet I hold that the defective nutrition which is the direct cause of it depends, to some extent at least, on the deficiency in the food of those mineral constituents which are as essential as the flesh-formers and heat producers. Every article of diet, whether animal or vegetable, has its own mineral constituents, and these vary, not only in quantity, but very markedly in their nature and proportion. In some the leading ingredients are phosphoric acid and lime, or phosphoric acid and potash; while in others we find chiefly alkaline salts. In milk, the food specially provided for the young, not only is the saline matter excessive, constituting 5 or 6 per cent. of the entire dry substance, but there is a large proportion of phosphate of lime, the leading constituent of bone. Hence it is a fair inference that any food or mixed diet which does not provide this compound in sufficient quantity is unwholesome for the young, and is probably, although in a less degree, unsuitable for healthy adult life.

I may here quote an analysis by Marchand of the *femur* or thighbone of a ricketty child.

Cartilage.....	72·20
Fat	7·20
Phosphate of lime	14·78
Phosphate of magnesia	·80
Carbonate of lime	3·00
Sulphate of lime, Chloride of sodium, oxide of iron, and loss	2·02
	100·00

In contrast to this, the same bone in a subject free from this disease contains, instead of the 20·6 per cent. of earthy matter given above, 64 per cent. of ash, consisting of the same salts, and very nearly in the same proportions. In *rachitis*, therefore, the effect is due to the diminution in the *quantity* of the phosphate of lime and other salts, and not to the absence of any

particular ingredient, or the abnormal introduction of any foreign constituent.

An attempt was made some years ago by some medical men and chemists to show that the hardness of water supplied in towns and cities had an important bearing on the subject we are discussing; and statistics, which, it has been well said, can be made to prove anything, were collected, in which it was apparently shown that the general health of the inhabitants of towns in which hard water was used, was better than those using soft water. More careful and general observation has, however, completely demolished the theory, while, on the other hand, it has been shown on evidence which has been considered satisfactory to physicians of the highest standing in their profession, that the constant use of certain very hard waters, and especially those containing an excessive proportion of sulphate of lime, gives rise to disorders of a somewhat serious description, particularly in old people. Now, in regard to the particular disease of which I have spoken, water, either hard or soft, unless contaminated by sewage, contains no phosphate of lime, or at most, only the most minute trace, which can be detected only by the most delicate chemical tests. Then, in regard to lime, which is at least one of the constituents of phosphate of lime, let us see how much of it there is in hard waters as compared with soft. Taking the whole of the lime as carbonate, hard water supplies contain 12 to 20 grains per gallon, soft waters 1 to 5 grains, and those of medium hardness 5 to 12. Now the quantity of water consumed in food or otherwise by an average human being may be taken at 40 ounces, or quarter of a gallon per day. This, I should explain, does not include milk, beer, wine or spirituous liquids, but only the water used for drinking, and that mixed with our food. It follows, then, that in a hard water town, such as London, where the hardness is about 16 degrees, the total quantity of lime taken as carbonate may amount to 4 grains per day, while in Glasgow it is little more than $\frac{1}{4}$ of a grain. In regard to children, who require relatively to their size much more mineral food than grown persons, there is comparatively little water used, while milk enters very largely into the diet. 20 ounces of milk per day is quite a moderate quantity for a growing child of four to eight years, and this quantity contains upwards of 50 grains of saline matter, a large proportion of which is phosphate of lime. Now as regards this particular ingredient, the quantity taken by a child in milk alone in one day will equal that introduced in the water, be it hard or soft, consumed by a grown person in about 10 years. But possibly the lime in water might be useful in making up the deficiency of that ingredient in certain articles of food; and

it is the fact that many substances of common consumption, such as bread, while they contain much phosphoric acid, have in their composition comparatively little lime. But even bread contains some lime; taking it as carbonate, as we did in the case of water, a pound of bread of an ordinary description contains about 4 grains, while other common articles of diet have a much larger proportion. I give here, in a tabulated form, a list of a few articles of diet, with the proportion of mineral matter, or ash in each, and also the proportion of lime and phosphoric acid in 100 parts of the ash:—

		In 100 parts of ash.	
	Ash per cent.	Lime.	Phosphoric Acid.
Flour	·8	3·4	50·7
Oatmeal	2·1	8·5	42·4
Barley	1·1	3·4	29·9
Rice	·5	7·2	60·2
Indian Corn...	2·0	3·1	44·5
Peas	3·0		
Potatoes	1·1	1 to 4	15 to 20
Turnips	·8	7 to 35	3 to 8
Carrots.....	1·0	6 to 12	8 to 12
Beetroot	·9	4·8	2·8
Cabbage	1·2	11 to 23	10 to 20
Apples	·4		
Gooseberries...	·5		
Grapes	·4		
Figs	2·3		
Dates	1·6		
Milk, Cow's ...	·7	17·3	28·4
„ Woman's	·15	42	32·4
Cheese, Swiss..	5·1	17·8	20·4
Eggs.....	1·3	10	33
Beef	5	5·1	39·3
Veal	4·5	2	48
Mutton	3·5		
Pork	1·5	7	42
Tea	5·5	8 to 11	8 to 17
Coffee	4·5	4 to 6	10 to 11
Cocoa	3·5	11	29·6

The estimated total amount of mineral matter consumed daily by a grown person is 170 grains, and I calculate that this quantity of ash of an average diet will contain lime equal to 33 grains of carbonate, so that the four grains taken in hard water would make no appreciable difference.

In all the articles of food I have mentioned phosphoric acid is a prominent ingredient, and in some it constitutes at least half the weight of the total mineral matter. But I have to point out that all the flesh-forming constituents of these alimentary substances contain phosphorus in organic combination, and this appears in the ash as phosphoric acid. In like manner, the urine, which contains the partially oxidized products of the wasted tissues of the body, has, as one of its leading components, phosphoric acid, existing partly as phosphate of lime, partly as phosphate of magnesia and ammonia, and partly in the free state. It is therefore natural that we should find in the ash of most articles of food phosphoric acid largely in excess of that proportion which would be required to combine with the lime that is present.

Of all the substances used for food by civilized nations none is so universally or so largely consumed as wheaten flour, and yet there are few which contain so small a proportion of mineral matter. If we take the dry substance in each article (for many vegetables and fruits, for example, contain 80 to 90 per cent. of water) I think there is none which contains so little ash as wheat, with the single exception of rice, and even it, as I shall presently show you, has more mineral matter than the finest flour. The dry substance of milk contains about 6 per cent. of ash, of eggs 5 per cent., of potatoes 4 per cent., of turnips 11 per cent., of carrots 9 per cent., and of cabbage 11 per cent. I think it is a fair inference that, as wheat contains naturally a comparatively small proportion of mineral matter, we should not use means to reduce it materially.

It will be useful here to give two analysis of wheat, which I made some time since. The first is of a sample of the finest Hungarian wheat, such as is used for producing the highest quality of Austrian or Hungarian flour; the second is a mixture of Scotch, American, and Baltic wheats, such as is used for making flour of ordinary quality in Glasgow.

ANALYSIS OF WHEAT.

	Hungarian.		Mixed Scotch, &c.
Albuminous compounds ...	12·29	.....	11·17
Fat or oil.....	1·90	.....	1·96
Starch, &c.....	70·50	.....	70·97
Vegetable fibre	2·16	.....	2·36
Ash or mineral matter	1·53	.....	1·75
Water	11·62	.....	11·79
	100·00	.....	100·00
Phosphoric acid in the ash...	·70	.....	·74

There is here a difference of one per cent. in the flesh-forming or albuminous compounds in favour of the Hungarian wheat, and about ·2 per cent. in the ash in favour of the mixed sample. The other ingredients do not differ materially.

I made, at the same time, analyses of the flour obtained from each of these wheats; the Hungarian being the finest and whitest flour obtainable by the Austrian system of grinding, while that from the mixed wheat was simply a good, white, Glasgow-made flour. The prices of these flours are at the present time, respectively 48s. and 35s. per 280 lbs., or per pound 2·06 pence and 1·5 pence. In round numbers the relative prices are 4 and 3. We should expect, therefore, to find the dearer flour much more nutritious than the other, or to have some other quality to recommend it.

Here are the chemical anaysis of the two samples:—

ANALYSIS OF FLOUR.

	Hungarian.		Mixed Scotch, &c.
Albuminous compounds.....	10·62	.....	10·04
Fat or oil.....	1·40	.....	1·69
Starch, &c.	75·35	.....	73·92
Vegetable fibre	trace	.....	trace
Ash	·38	.....	·85
Water	12·25	.....	13·50
	100·00	.....	100·00
Phosphoric acid in the ash...	·14	.....	·34

Let us compare these two analyses. In the Hungarian flour we have a larger proportion of albuminous compounds, to the extent of ·58 per cent.; while in the Glasgow-made flour we have a little more oil, and *more than double the proportion of ash.* This white Hungarian or Austrian flour has actually less mineral matter than rice, which contains ·5 per cent., and which is distinguished among vegetable productions for its very small proportion of this constituent. I may here say that some of the millers in the United States, having adopted the Austrian system of milling, are producing a similar quality of flour, and I found in a remarkably fine and white sample of American flour—

Albuminous compounds.....	10·62
Fat or oil.....	1·14
Starch, &c.	74·34
Ash	·34
Water	13·56
	100·00
Phosphoric acid in ash	·18

Wheat, as we have seen, contains from 1½ to 1¾ per cent. of ash, but it is very unequally distributed in the grain. The outer part contains by far the larger proportion of mineral matter, and it is also more nutritious. In illustration, I quote some figures selected from researches made by Messrs. Lawes and Gilbert, the well-known agricultural chemists. I may say that the wheat was grown by themselves, and contained 1·9 per cent. of ash.

Mill Products.	Proportion for 100 of grain.	Ash per cent.	Albuminous Compounds.
1. Wire 1	51·2 ...	·71 ...	10·19
2. „ 2	24·8 ...	·74 ...	10·56
3. „ 3	1·7 ...	·82 ...	11·12
4. Tails	1·6 ...	1·04 ...	11·62
5. Fine sharps or middlings	3·3 ...	2·19 ...	13·81
6. Coarse sharps	3·3 ...	3·93 ...	16·12
7. Fine pollard	1·8 ...	5·46 ...	15·25
8. Coarse pollard	6·7 ...	6·56 ...	15·12
9. Long bran	5·0 ...	7·14 ...	15·00
	99·4		

I have ventured to introduce this subject to the Congress, because I think it is a most important one, and because we in Glasgow suffer especially, as I think, from the use of excessively fine and correspondingly dear flour. For my own part, I never eat white bread if I can get what is called household, or still better, whole-wheat bread; and I think a little education would incline the general taste in the same direction. But it is the fact, that the people of Glasgow, and particularly the working classes, eat nothing but the finest bread, rejecting the good, honest, and eminently wholesome bread made from home-made flour, as if it were unfit for human food. I have heard it said, that natural instinct, in this as in other matters, is an infallible guide, and that there must be something great and good in fine flour, although the chemist cannot discover it, which causes it to be so much prized. For my part I say it is not an instinct, but a mere fashion; and one as pernicious and absurd as tight lacing in our own country, or the compression of the feet of women in China.

It is greatly to be regretted that the use of oatmeal is gradually but surely being given up by the working classes in Scotland, especially in large towns; and there cannot be a doubt that the liberal use of porridge and milk, as contrasted with white bread and tea, would, in a great measure, prevent the development of the disease to which I referred at the commencement

of this paper, and would improve the general health of the people. Can nothing be done to arrest the displacement of the wholesome and strengthening national food by articles which are radically defective?

Mr. T. H. HARRISSON (Liverpool), remarked that the Bread Reform League were doing very good work in the direction indicated by Dr. Wallace.

Mr. G. W. MUIR (Glasgow), said the reason why people preferred the fine wheat was that the brown loaf was charged at the same price as the fine loaf, and the people did not like to pay the same money for what they knew cost less. He himself never used anything but wheat and meal bannocks and oatmeal cakes.

Mr. J. J. COLEMAN, F.C.S., pointed out the danger of corn flour for children. That flour was deprived of its most essential constituents, and he had know cases where children were almost exclusively fed on it. The inevitable result had proved to be insufficient nutrition, and the consequences serious.

The CHAIRMAN said Dr. Wallace had called attention to the supply of hard and soft water as affecting the bone matter. He only wished to make one observation borrowed from the late Professor Clark, of Aberdeen. The professor had a very strong opinion in regard to the value of soft water, and he invented a process for the softening of it. When he was examined on the subject by a Committee of the House of Commons he was asked whether the loss of lime by using soft water would not prevent the growth of bone? To this the professor replied: "The water at Aberdeen is about the softest in the kingdom, and the people of Aberdeen are the largest boned of Her Majesty's subjects." The Chairman, speaking on the question of food, said he used oatmeal daily, but he feared they saw already indications of deterioration in fibre in large towns from the excessive use of tea and fine bread.

On "Disinfection by Heat, with Description of a New Disinfecting Chamber," by JAMES ADAMS, M.D., L.R.C.S.E., F.F.P.S.G.

To Dr. W. Henry of Manchester is due the merit of conceiving and demonstrating by actual trials the fact that heat destroys or neutralises the morbific matter of certain communicable diseases. In 1832 (Phil. Mag., vols. x-xi) he published the results of experiments, showing that cow-pock matter be-

comes totally inert after an exposure *of some hours* to a temperature of 140° F., and that clothing designedly infected with scarlatina and typhus *contagium* was afterwards worn with no bad results by individuals likely to be susceptible, such clothing having previously been confined *for some hours* in a temperature of 200° to 206° F.

Since the time of Dr. Henry, various methods have been employed for practically utilising his richly suggestive conception, but in some instances without observance of his precautions, of which more hereafter. Meanwhile, a short reference to the nature and properties of the matter that transmits contagious disease will aid my description of a new Disinfecting Chamber professing to have some important distinctive features.

Of the constitution of morbid poisons we are as ignorant as of that of prussic acid or of strychnine, nor is it probable that the knowledge, if we possessed it, would throw any light on their mode of action, so far as relates to the essential morbific principle. We are well acquainted with their *chemical composition* without in any way understanding how they act so powerfully on the animal system; but we know they are capable of being decomposed by weak chemical agents, and rendered inert by temperatures of about 200° F., and therefore that their constitution is not stable, and that they are held together by very feeble affinities.

That contagion is connected with the diffusion of oganisms possessing vitality may now be assumed as an established axiom. This doctrine, known as the "Germ Theory," is usually ascribed to Pasteur, and it is undeniable that he is entitled to pre-eminence in enunciating the truths on which the doctrine is now so soundly based. But the notion was held as far back as 200 years ago, and originated with Kircher, who advanced the view that *animalculæ* or *acari* diffused through the atmosphere was the true originating cause of epidemic and contagious diseases. His opinion was endorsed by Linnæus, and advocated by other eminent men, but did not meet acceptance among physicians. On the contrary, it was by them, until a recent date, held that there existed a deleterious principle or medium, vaguely expressed by such terms as "fomites," "virus," "effluvium," &c., which became contagious or epidemic by some occult and mysterious influence, some "corruption of air," or some spontaneous change in inanimate matter. And it is illustrative of the general notions that long prevailed, and at same time interesting in the present connection to note, that Dr. Henry, who devoted much consideration to the problem, and whose name is so honourably associated with the subject of disinfection, was a strong disbeliever of Kircher's hypothesis, and characterised it as singularly

unsound—as having not a single valid analogy to confirm it—and as being at variance with all that is known of the diffusion of volatile contagion.

So late as 1860 the mysterious *something* that originated epidemic and contagious disease, was a matter of keen controversy, and was generally believed to have its most probable solution in establishing or disproving the doctrine of Spontaneous Generation, regarding which the views of the illustrious Liebig were held open to refutation by his no less illustrious contemporary, Pasteur.* The continuous and untiring researches of Pasteur, aided by others, and at a later date very materially by those of his able expositor, Tyndall, have clearly demonstrated not only the fact of the generation of certain communicable diseases by living organisms or "germs," but have gone far to make it very probable that it is through living organisms or germs that all zymotic diseases are propagated. According to this doctrine putrefaction and epidemic disease alike, arise, not from the air but from something contained in the air. This something is not a vapour, nor a gas, nor a molecule of any kind, but a *particle* or bit of liquid or solid matter formed by the aggregation of atoms or molecules. Tyndall has shown that the air is at all times, even when free from microscopically visible particles, beset with much smaller ultra-microscopical particles, and he alleges that air from which the particles have subsided—air which is "optically pure" as determined by the electric beam—is no longer capable of contaminating liquids, or of inducing fermentation or putrefaction. From such facts and from a review of the whole field traversed by other observers, he concludes that these particles are organisms, the germs of septic Bacteria. "The thing" he says, "which we vaguely call a 'virus' is to all intents and purposes a seed * * * as surely as a thistle rises from a thistle seed, as surely as the fig comes from the fig, the grape from the grape, the thorn from the thorn, so surely does the typhoid virus increase and multiply into typhoid fever, the scarlatina virus into scarlatina, the small-pox virus into small-pox."

This "virus," these particles or germs, are *volatile*—are shed freely from infected individuals and from their clothing, and are wafted to and fro by ærial currents. Hence all appliances which have for their object to limit the spread and ensure the destruction of these germs should be planned with special provision for this dangerous property of volatility in the germs of disease.

While the hypothesis of spontaneous generation was in de-

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* See Addenda.

pendence and under anxious discussion throughout the scientific world, heat was the chief agent employed to determine the actual vitality of microscopic forms that are developed so abundantly in infusions of organic matter, and even in saline solutions. And while there was a general *consensus* to the effect that heat destroyed the evidence of vitality drawn from active movements, there was a great conflict as to the *degree* and *duration* of heat required. Moreover, there was a renewed generation of the same forms frequently observed in the liquids supposed to have been sterilised, which naturally gave rise to the belief in spontaneous generation. The first light thrown on this perplexing riddle was by Professor Cohn of Breslau, who showed that confusion and contradiction had arisen from having failed to distinguish *the growing germ* from its seed or spores. And it was reserved for Professor Tyndall to pulverise and destroy for ever the doctrine of spontaneous generation by an exhaustive series of brilliantly conceived and thoroughly conclusive experiments. He showed that the vitality of a germ or embryo organism and its disposition to development was a latent property dependent on different conditions of spores, age, dessication, exposure to air and light, &c., and that subject to these varying conditions there were required varying periods for germination: that in the operation of boiling that was usually adopted for their destruction, the broods or crops may overlap each other, the new brood making its appearance before the old brood died away, and that by repeated boilings at short intervals—and not by prolonged boilings—dealing with each successive crop as it springs into active life, there was effected ultimately a complete destruction. Finally he showed how all preceding observers had failed in their best intended efforts to procure a condition of the air absolutely or—as he phrases it—"optically pure"; and with this necessary condition of purity secured, he predicted with an accuracy that has not since been gainsaid, that there never would again occur an example of so-called spontaneous generation.

The distinction to be observed between the seed itself, and the developing organism, cannot therefore be too strongly impressed on the mind when dealing with methods of germicide. Notoriously the growing or adult organism can be easily destroyed. Not so the seed. The contrasted difficulty has been well expressed by our senior city member, Dr. Cameron, in his very instructive and in every respect excellent monograph on "Microbes." Dr. Cameron says "as to the spores which they [*i.e.* the developing or adult organisms] produce, and from which succeeding generations spring, there is almost no killing them. The more you dry them the better they resist destruction.

Time is no object with them and they maintain their dormant vitality for an indefinite number of years. Absolute alcohol has no effect on them. As to oxygen they can stand that concentrated by the pressure of twenty atmospheres, and be none the worse. Two or three hours' boiling if they have been well dried beforehand, seems not to hurt them, and they have even been known to resist eight hours' of the process. *The only effective means for their immediate destruction that I am aware of is the flame of a spirit lamp.* To that their extreme minuteness renders them an easy prey."

But Pasteur never saw germs resist 230° F., or the adult organism from 122° to 140° F. *when in the moist state.* Chaveau, Calvert, Roberts, Tyndall, and many others, have shown that from 140° to 212° F. is a degree of heat that few developed germs can sustain. According to the very recent experiments of Koch, Wolffhügel, Gaffky, and Lœfleur, exposure to temperatures of 212° to 221° F. in dry heated air effects easily the destruction of Baccili and "adult" Bacteria, while *spores* of mould were not killed after being subjected for one and a half hours to air heated from 230° to 240° F., and *spores* of Baccili were destroyed only after being confined for three hours in an atmosphere of 284° F. On the other hand, these last-named observers have given very important evidence as to the difference in effect of heat according as it is dry or humid, for they found that spores of garden earth and of carbuncular disease lost all vitality by an exposure of only ten minutes in hot vapour registering 230° F., and they assume that this is the temperature to which ought to be heated any morbific principles of an unknown nature which can transmit disease. Their experiments show that in a practical point of view one cannot have absolute confidence in dry heat for the disinfection of all suspected objects. On the whole it may be affirmed that duration of heat and its degree are mutually complimentary both with dry and with moist heat, a long exposure to a low degree being equivalent to a shorter exposure to a high degree.

The natural inference from such experiences is that in seeking to disinfect by heat, that heat should be carried as high, and contined as long as is possible, or necessary, to ensure the destruction of infective matter; subject only to the limit that infected clothing or other articles operated upon, may not be injured or destroyed. And in determining the practical limit that is expedient, I have again to make honourable mention of Dr. W. Henry, who made practical trials 50 years ago on fabrics of clothing and other articles, which have left little save gleanings for subsequent observers. For the experiments of Ransom, Chaumont, Vallin, Koch, Wolffhügel, and others have added

little beyond a confirmation of Dr. Henry's conclusions, and to these later observations I need not therefore refer in detail. They show in summary, that exposure in dry heated air to a temperature of 220° to 230° for one or two hours is sufficient for disinfecting purposes, and does not injure the integrity nor the appearance of ordinary clothing and bedding, but that a temperature of 250° is risky, may cause injury, and is therefore unnecessary.

In considering the practical application of heat to infective matter for disinfecting purposes, we need not take into account the exceptional laboratory experiences of various observers who have recorded extraordinary degrees of heat withstood by some germs. These are little likely to be noticed in future now that Tyndall has specified so clearly the conditions under which they are likely to have occurred. These rare instances are matters of curious interest more for the naturalist than for the sanitary physician. The general evidence now accumulated, is abundantly sufficient to warrant the conclusions recently laid down by Pasteur and Leon Colin in their Report on Disinfecting Stoves, made in 1880 to the Council of Health of Paris and the Seine. These are to the effect that while humid heat of 212° F. will certainly destroy all life in morbid germs and all dangerous condition in virulent matter, a temperature between 212° and 230° F., whether dry or humid, may be fixed as sufficient for all practical purposes. A higher temperature is unnecessary.*

Whcn selecting an apparatus for disinfecting by heat, there is a somewhat embarrassing choice between those which are more or less portable, and sold in the ordinary course of commercial manufacture, and those which are erected on an extensive scale to special designs and for the needs of a large population —between those which are employed for occasional use, and those where the process of disinfection may be a matter of daily or hourly requirement. In a description of my own apparatus I will, therefore, best indicate the points wherein others in frequent use seem defective, and wherein my own contrivance seems to supply a desideratum. I say so much because I was led to realise my conception on the request of Major-General Collinson, Architect to the Prisons' Commission for Scotland, who did not find in existing apparatus the economy and convenience or efficiency that were desirable, and in his view attainable. He sought a portable appliance that could be easily fitted up in an ordinary appartment of a gaol, and be quickly brought into use for the few hours during which disinfection of clothing, &c., was occasionlly required. Dr. Littlejohn, with whom I also freely

* See Addenda anent high temperature.

discussed my plan, and to whom, as well as to General Collinson, I exhibited a small model, was clearly of opinion that the apparatus was peculiarly suitable for the service of gaols, workhouses, small hospitals, small country towns and various localities where the use of disinfecting chambers were practically excluded, because of first cost usually was then doubled by the conjoined expense of a special building, and subsequent considerable cost of working, irrespective of their shortcomings in real sanitary efficiency. Several medical officers of health with whom I have since exchanged views, have added their cordial concurrence in this opinion.

The "principles" on which my chamber is planned have reference to the following points. 1. Portability, cheapness of construction, and economy in use.* 2. Improved method of causing heat and of preventing subsequent waste of fuel. 3. Equality of heat throughout the chamber. 4. A maximum or any desired temperature maintained by a simple contrivance acting automatically. 5. Germs or other infective matter disengaged from infected objects, not permitted to escape into general atmosphere. 6. Infected objects not exposed to products of gas combustion, but only to pure air, conjoined with moisture when desired. 7. Gas consumption regulated by automatic governor to an efficient average quantity.

These points I will now comment upon.

The sides, top, and bottom of the chamber form so many complete pieces, prepared, adapted, and numbered in the workshop so that they can be easily put together by any ordinary workman. The interior is furnished with the usual rods and hooks for supporting articles that are being disinfected. A powerful gas stove of peculiar construction, exposing a large heating surface in its interior traversed by pure air, is connected inside or outside of the chamber, preferably on the outer side. It is then only necessary to attach the gas supply and lead the stove flue into the chimney of the apartment in which the chamber is placed. The walls of the chamber consist of double casings made of thin plates of sheet iron, one-and-a-half inches apart, air tight, and containing only confined air. Each casing is farther subdivided by partitions to prevent heated air accumulating in the higher compartments. Confined air is the best non-conducting medium and renders unnecessary the packing material that is usually employed. Such packing in the degree in which the material is solid, necessarily absorbs heat at

* The company that manufactured the workshop model shewn at the Sanitary Exhibition at Glasgow has, with my permission, taken out a Patent, and I am informed that the selling price of a chamber of 130 cubic feet inside capacity will be about £40.

the beginning of an operation and prolongs the time requisite for getting up the desired temperature. Such packing—the most useful of which is boiler felt—may, however be applied to my chamber with good effect when it is intended to be kept in use for many hours or days at a stretch; otherwise it is unnecessary. A case of wood lining outside, with an inch space between it, and the sheet iron forms a second air jacket, and the wood, by its slow conducting and radiating properties, conserves the heat still farther.

The bottom of the chamber is double, having about six inches deep of an under space communicating by openings at one end with the general interior. The heating stove, whether placed within or connected outside, draws air from the under floor space through two separate pipes, one leading to the furnace, the second admitting air to the pure air caliducts of the stove. The under floor space, therefore, communicates at one end with the general interior of the chamber and at the other end with the stove, and the air drawn from the under floor space divides into two currents, one of which passes through the furnace and ultimately escapes into the chimney of the apartment. The

other and much larger current follows a separate course through the stove where it becomes highly heated, and is discharged in a pure state into the chamber. 'It is not then permitted to escape outside, but is drawn down through openings into the under floor space, and again led into the stove highly heated, and again discharged into the chamber, with each circulation gaining increased heat until the maximum temperature desirable is attained. And so the circulating current goes on traversing and retraversing the general chamber from end to end and from top to bottom in brisk movement as long as the stove continues lighted. The "principle" of action is analogous to that of heating by hot water pipes. This automatic movement of hot air in a circle ensures a nearly equal temperature throughout the chamber. The briskly moving current passes through the suspended clothing more effectively than a stagnant atmosphere can penetrate. It plays in the manner of a light breeze, rustling the garments, disengaging and floating off infective matter, while the rapidly successive impact of heated air molecules must oxidise more effectively than a still atmosphere.

The volume of air drawn through the stove furnace would suffice to fill the chamber more than twice every hour. That quantity is replaced by fresh air continuously admitted from the exterior through a simple valve that prevents reflux. The much greater body of air that moves through the chamber in an automatic circuit would suffice to fill and empty it about fifteen times within an hour, giving a complete revolution and replacement about once every four minutes. All infective matter volatilised and floating in the larger current is therefore being continuously heated and re-heated within the pure air caliducts of the stove, while any matter floating in the smaller current that is being continuously drawn through the stove furnace and burned gases caliducts, is thoroughty carbonised and conclusively dealt with. At the expiry of the time given to the operation, an aperture in the upper part of the chamber is opened to permit the escape of the confined air, which passes through a pipe that has its point of discharge underneath a solid gas flame, so that any infective matter still suspended in the air must pass through this flame. *Thus, from beginning till the end of the operation, all volatilised matter liberated in the chamber must pass through flame.*

I place much stress, and not unduly, on the paramount importance of imprisoning volatile infective matter throughout the entire period given to a disinfecting operation. There is otherwise a very fallacious security. The quantity of epidermic scales shed from the skin of patients affected with typhus, scarlatina,

smallpox, and other eruptive fevers throughout the desquamative or convalescent period is very great, and these together with the more subtle, or less visible emanations exhaled by the skin or breath, or the grosser discharges from typhoid or diptheritic patients, contain the matter that makes those diseases commuicable. I have seen the shirts and other clothing of such patients when held up and briskly shaken, discharge clouds of contagious dust, similar to what takes place in shaking a flour bag. Now this infective matter may be dried and exposed to the air for weeks together, and yet lose little or nothing of its virulance, and this dust constitutes the infective particles or germs that we dread should float from a sick room into the adjoining apartment of a dairy or farm-house where it may settle in the milk vessels—that we apprehend from the association of our children with school mates recently convalescent, or coming from an infected house—that we fear may be suspended in the atmosphere of a cab that has conveyed an infected patient. How evidently necessary it, therefore, is that in a disinfecting operation there should be provision made for following up to utter extinction such contagious matter. The facts that have within so recent a period been adduced, and that since are daily illustrating the vital importance of the "Germ Theory" were not in the prevision of those who designed the gas disinfecting chambers at present in frequent use throughout the country. There is not in many of them any provision for such heroic treatment as I am advocating. In some the infected clothing is merely hung up in a chamber traversed by a current of hot products of gas combustion that enters at the bottom, and passes instantly out at the top. The shirt or blanket may be detained for a conventional period of two hours or thereby, but any volatile matter that is disengaged, is instantly swept off into the general atmosphere. The shirt or blanket is itself disinfected and may afterwards be worn with impunity, but where do the infective "particles" alight? They have not been detained for two hours nor for as many minutes. They have not been subjected to the necessary temperature during the necessary period of time, nor for any notable period of time. They cannot under a momentary exposure to heat of 230° or 250° have been rendered inert. They have simply been blown away to join the idle wind that wanders where it listeth; and we never can know what becomes of them during the weeks, or it may be years, that they retain their deadly properties, although we may conjecture when we meet epidemic and contagious disease springing up in some locality under inexplicable conditions. Dr. Henry detained his cow-pock, scarlatina, and typhus matter within his

heated laboratory oven for *hours*, proving as he cautiously proceeded that time was an all important condition in disinfecting by heat—that sometimes a duration of exposure for one hour, sometimes for two hours was insufficient, and that where he stopped short the contagious matter retained its potency. All subsequent observers have followed in the same lines, and confirmed substantially his conclusions.* When Pasteur, Tyndall, and others, boiled the germs on which they operated, they found at one time one hour, at another time three hours too little. But we now know through the teachings of Tyndall that at the beginning of a heating operation there may be germs in such an embryo state that heat of a certain duration only stimulates their growth a stage, and if at this stage the exposure to heat be discontinued, the germs retain their vitality, although—as shown by Pasteur—in a frequently attenuated condition that impairs their subsequent activity or virulence. Heat must therefore be long continued, or it must be renewed more than once, or it must be applied in the form of actual flame, a verification of the old adage "fire purifies all." Less capable observers than Pasteur and Tyndall stopped short in their process of boiling the liquids they assumed to have been sterilised by one boiling operation, and when afterwards vital organisms appeared in the liquids, these were assumed to be examples of "spontaneous generation." Let it be assumed that in the experiments of Pasteur and Tyndall, there had been permitted to boil over from their flasks a number of germs not yet sterilised, these would have dried up, and afterwards have become capable of being developed through ever active agencies. What did occur in the fallacious observations referred to, and what might occur, are conditions analogous with those which obtain in a chamber, where volatilised *contagia* are floated from off the surfaces of infected clothing and wafted into the general atmosphere on a strong up-rushing current of burned gases. The best known of these chambers is in its mechanism fashioned with an ingenuity that reflects credit on its inventor, and from its commercial success has been honoured with imitations, but that chamber was in its "principles of action" designed eighteen years ago, and consequently before the "germ theory" had become an accepted fact. In the light of our present knowledge that chamber and all others of like "principle" are behind the time.

It is not that products of gas combustion have, or are alleged to have, any destructive effect on germs, or any effect whatever apart from their heated condition that differs from pure air, or

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* See Addenda.

a mixture of air and watery vapour. It is, on the contrary, open to surmise that certain products of gas combustion—certain tar products—may actually have a temporary conservative effect of the kind that Dr. Dougall, of this city, showed to be produced by the vapour of carbolic acid on vaccine lymph. The variations in the products of coal gas combustion, according as that is more or less perfect, and the variability in the composition of coal gas, its impurities and the like, make this surmise a point worth consideration. Dr. Dougall, whose researches on chemical disinfectants are, in extent and original conception, second to none, is of opinion with me that the influence of burned gases is not only probably, but very likely, of the nature I have suggested. But assuming that they have no influence either for good or for evil, so far as destructive action on germs is concerned, it still seems to me that to avoid pure air and to make choice of an atmosphere contaminated with the products of gas combustion, is something equivalent to a preference for dirty water before clean water for washing purposes. It might be tolerated if no other method of applying heat was available, and it is an extenuation if used in the belief that exposure to the burned gases of gas coal will do no harm. But on this latter point I have grave doubts, and if compelled to give over my property for disinfection, I would be very fearful of the results of exposing a piece of fine lace, a delicate coloured silk fabric, the valued photograph of a deceased friend, a precious letter, or an important law document to be played upon for a couple of hours by a strong current and heavy atmosphere of burned coal gas.

Setting this point aside, it is deserving of note—although the least of probable evils belong to the use of such chambers—that the waste of heat, and consequently of fuel is so great, that the hot products of combustion escape in enormous quantities, carrying off heat that has been only partly utilised, and this waste of heat is aggravated by the method of burning, in which the rush of inflamed gas is accompanied by a practically unlimited quantity of unnecessary cold air that mixes with the hot gases, dilutes and cools down their temperature, and renders one-half or two-thirds of the heat ineffective. Instead of the gas being burned with about ten volumes of air to one of gas, the theoretic proportion, or even twenty volumes, which is the practical limit aimed at by all who have studied the laws of gas and coal combustion, I have estimated that from 150 to 300 volumes of air are admitted into such chambers for each volume of gas. But so little consciousness does there seem to be of extravagant waste on the part of the makers, that I have seen a letter written from one who refers to 50 or 100 cubic feet of

gas per hour as the required quantity for his apparatus, and as a quantity "not worth consideration." And yet a chamber of equal capacity can be equally heated with pure air by the use of 20 cubic feet of gas properly burned and properly applied. Before leaving this question of *pure air* versus air contaminated with burned gases, I may plead that while pure air can have no hurtful action on clothing or other infected objects, it has on the other hand assuredly an oxidising and distinctive action on infective matter. Still farther let me urge that there can exist no valid reason why the same chamberful of air when once heated, should not economically be made to do duty again and again in the manner of hot water warming apparatus, more especially when the heat can be kept up to give all the effect that heat can give by the use of one-third or one-fourth of the gas fuel that in contrasted arrangements is *avoidably* wasted.

I turn to a description of the means I employ for maintaining a desired maximum temperature. A thermometer fixed inside the chamber, but visible outside, indicates the heat. A single Arnott chimney valve, specially balanced and regulated, supplies every other necessary requirement. This valve consists of a thin leaf of metal resting with a fine edge upon a delicate balance socket. A rod with a screw turned upon it, and having a weight at its extremity is attached to this balanced leaf, and by rotating the screw the weight is shortened or lengthened from its fulcrum. The principle of the valve is that of a balance having at one end the elastic force and pressure of air confined at 250° F. (or any other temperature that the valve is weighted to withstand the elastic force of) and at the other end the equivalent force or counterpoising weight of metal attached to the valve. When the air becomes heated above 250° F., the elastic force and pressure upon the valve is increased, the valve yields and the heated air escapes until once more the pressure of the air and the weight of the valve become equal. The adjustment of the valve is made when the thermometer reaches 250° F. (the temperature at present assumed for illustration) and it is effected by simply turning the milled head, which, for convenient manipulation, is attached to the screw rod. When the valve is perfectly vertical at 250° F., preventing all escape of heated air, but yielding at 255° F. or thereby, the adjustment is practically perfect, and requires no further attention for that temperature. By this contrivance I dispense with costly arrangements easily deranged, and in practice not admitting of ready adaptation to varied standards of temperature that may be desired, while other automatic arrangements when out of order can only be repaired by specially skilled workman.

To meet the requirement that has arisen from recent observations, showing that moist heat is more effective than dry heat, I employ a simple provision whereby the chamber is charged with watery vapour, subject to the same control as regards temperature, as in the case of dry air. A shallow vessel containing a quantity of water, about 16 oz., is placed in the line of the entering hot air. The water evaporates, and the moisture condenses on the colder clothing, ultimately becoming steam of the elastic force, proper to a mixture of air and moisture at 250° F. Should the temperature exceed 250° F., the valve moves precisely as in the case of dry air alone; for in all cases the sum of the elastic forces of a mixture of moisture and of air is equal to the weight of the atmospheric pressure, which has its equivalent in the weighted balanced valve, the vapour taking always the force due to its temperature, and the air making up the complement. The arrangement is entirely free from the cost, difficulty of management, and dangers attendant on the great elastic force of steam generated in and delivered from a high pressure boiler.

In the application of moist heat it is desirable that the watery vapour should be generated at the early part of the disinfecting operation, and while the clothing or other infected objects are at a relatively low temperature, so that the moisture may become condensed upon them, and afterwards it is only necessary that the temperature of the vapour does not descend below 212° F. Instead of a water vessel, the object may be very well effected by suspending a piece of woollen blanket of about half-a-pound weight, wrung out of water, of which it will retain about 1lb. And it may be still better effected by simply sprinkling the infected articles pretty liberally with water, and directing that they are not to be removed from the chamber until quite dry. Under all circumstances, it will detract from the efficiency of the moisture, if that moisture is delivered at first of a high temperature, say 220° and upwards, because at these temperatures it approaches the condition of a perfect gas and will only act as dry heat.

After the strictures I have passed on any mode of disinfection by heat that permits the escape of volatile *contagium* into the atmosphere, it is only due that I should state that disinfecting by heat in a chamber which confines all volatile matter until the close of the operation, is carried out in various apparatus in frequent use. Dr. Esse of Berlin, who has given much attention to the subject, makes this the principle of several chambers constructed under his direction at the Hospital, St. Moabit. In one arrangement the infected articles are placed within a cylinder, which is itself contained within a

larger cylinder, the space between being filled with steam, and thus the inner cylinder is heated. There is no communication between the outer and inner cylinder, and the latter contains dry heat only. This is precisely the arrangement on a larger scale devised by Dr. Henry in his small laboratory apparatus 50 years ago. In another form Dr. Esse's chamber is lined or traversed with steam pipes. M. Vallin, in his comprehensive treatise on disinfection, objects to Dr. Esse's chamber that the air is stagnant and cannot have the heat penetrating property of hot air in motion. He suggests—and the suggestion is applicable to other apparatus—that at a stage of the operation a stop cock should be opened, admitting a jet of vapour for 15 to 45 minutes, having a temperature of about 212° F.; this vapour to be afterwards got rid of by ventilating openings, and the operation completed by dry heated air, so as to thoroughly dry the infected articles. He believes such an arrangement to be perfect. I think it will be evident that in my chamber, the process that M. Vallin recommends is practically ensured with this superadded advantage,—that ultimately all air or vapour that has been in contact with the infected matter is made to pass through a furnace.

Mr. W. Lyon, a London manufacturer, supplies a machine that confines all volatile *contagium* till the close of a disinfecting process, and also aims at carrying out the "principle" of moist heat; and as it professes likewise to introduce an entirely novel "principle" of action peculiar to itself, of which moist heat is the characteristic, that claim requires the detailed examination I give in an addendum, because of its novelty and, as I believe, of its fallacy.

In conclusion, and on a careful consideration of the entire subject of disinfection by heat, I feel warranted in laying down the following axioms, of which the first is a truism:—

1. That as contagious matter volatilised and diffused in the atmosphere is the chief condition that propagates contagious disease, it follows that the best preventative consists in excluding the entrance into the atmosphere of such contagious matter.

2. That any apparatus for disinfecting by heat is insufficient that does not make provision for detaining volatile contagious matter, and subjecting it to the same degree of heat, at least, and the same duration of exposure that is found practically necessary in dealing with infected clothing, bedding, and other objects.

3. That the alternate use of moist and of dry heat, or of both conjoined, is preferable to the use of dry heat exclusively.

4. That in disinfection by heat, the inmmediate and certain destruction of volatile contagious matter can only be ensured by passing such matter through the flames of a furnace.

ADDENDA.

In 1860 it was announced as a discovery by Schröder that "the atmosphere contains an active substance which induces the phenomena of fermentation and putrefaction, and which is decomposed by heat and arrested by filtration," although why muscle, yolk of hen's egg, and milk should occasionally putrefy in spite of filtered air alone being permitted to come in contact with them was a point most difficult to explain, and one which Schröder admitted was not in perfect accord with his theory. Pouchet about the same time cited several experiments which he considered crucial, and which he performed with the special object of settling the question of spontaneous generation, and he affirmed that the results of the experiments were perfectly conclusive as to the spontaneous origin of animal organisms. To test this doctrine Pasteur made very extensive investigations (published 1860) which resulted in establishing the fact that the air at all times contains microscopic organised corpuscles, which may be collected by filtering it through gun cotton, dissolving the cotton in ether, and allowing the ether to evaporate spontaneously. Pursuing his investigations into the origin of ferments and putrefaction, he in 1863 announced that his previous experiments had entirely disposed of the hypothesis that fermentation can be effected by the influence of decomposing albuminous substances, and affirmed conclusively that the sole agents in the process are animalcules or their germs, termed by him "vibrios," of which fact he adduced examples. From this date the "germ theory" made rapid progress, although strenuously resisted up to a very recent period by Bennett, Bastian, and other very able observers.

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Up till a comparatively recent date, the highest temperature short of actual injury to infected clothing, &c., have been employed or thought desirable, while by tradesmen who vend disinfecting apparatus, a minimum standard of 230° to 250° F., or even higher has been assumed and taught as necessary, and the power of producing temperatures of even 300° or 450° F. has been vaunted as a claim to recommendation. It should, how-

ever, be very obvious that in *all* gas heated chambers the *degree* of heat that can be reached above the highest heat that is necessary, *viz.*, 230° F., is a mere matter of so many extra feet of gas, and therefore implies no superiority in the apparatus, because an equal degree is attainable in *any* gas heated chamber. But the point that deserves consideration in this relation is the expenditure of gas at which any temperature that is desired can be attained and maintained.

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The important distinction that obtains between the vitality of the spore, or germ, or particles, and the organism which is developed from the spore, is all in all in considering the practical application of heat in the process of disinfection. For the quality, degree, or duration of the heat which destroys the vitality of Bacteria, Torula cells, spiral fibres, and fungi, fails to destroy the spore of the Bacterium. We have quite a cloud of witnesses as to the effects of heat on germs and their offspring, for the long contention on the doctrine of spontaneous generation that has so very recently received its quietus, brought into the field of practical investigation a host of observers. A very favourite method of experimentation consisted in heating or boiling infusions of vegetable or animal material, in which Baccili, Bacteria, and Vibrios are so readily and so abundantly developed. On the point merely of the degree of heat that will destroy Bacteria, there is a pretty general concurrence of experience, and Pasteur, Chaveau, Calvert, Roberts, Tyndall, and many others have shown that from 140° to 212° F. is a degree of temperature that few developed organisms can sustain. Haizings agrees with Cohn that Bacteria are killed by 10 minutes boiling, but against this general assertion Roberts has shown that the length of time varies greatly, according to the nature of the matter that develops the Bacteria, one kind requiring 20 minutes, another 40 minutes boiling. If, however, the infusion is rendered alkaline, Roberts alleges that it is not sterilised until one, or two, or even three hours boiling. Mr. Dallinger and Dr. Drysdale report that while certain living septic monads were killed by a heat of 140° F., there were spores of one variety that germinated after exposure for 10 minutes to 200° F. Instances are recorded of certain spores resisting for hours a temperature of 400° F. The resistance to destructive agents of certain spores is very extraordinary. Koch relates that the spores of splenic fever—a disease of cattle that occasionally affects, and it may be in a fatal form, the human subject—retained their infective vitality for an indefinite period in spite of all kinds of

mal-treatment. They could be reduced to dust, wetted and dried repeatedly, kept in putrefying liquid for weeks, and, nevertheless, at the end of 4 years they still displayed an undiminished virulence. Such experiences give point to the principle for which I am contending, *viz.*, that in disinfecting by heat, the only effective application for the immediate destruction of infective matter suspended in the air is to subject it to the action of the flame.

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I am not aware of any experiments exactly similar or so direct as those which Dr. Henry made with infective matter of cow-pock, scarlatina, and typhus. Those with cow-pock matter have been repeated, but the others have not. He dealt with what he recognised only as infective matter in the gross, and without thought or reference to germs. Our conclusions, therefore, regarding disease germs are drawn from a different class of observations, and mainly from the known analogies that link together the entire animal and vegetable kingdom. The number of species and the number of individual varieties of germs are very great, and a distracting multiplicity of names have been invented, and are being continually manufactured and applied by different observers in the field of investigation that is covered by the germ theory. And it is perplexing, even to a well-informed student of modern scientific literature, to track out the intended meaning of some writers who, within half a page, will make reference to half-a-dozen names all with little apparent discrimination, and often with little knowledge that they are dealing occasionally with mere synonyms. I give here a cluster of these ingeniously varied descriptions of minute organisms: cells, monads, germs, seeds, spores, sporules, torula, spirilla, vibrios, bacteria, baccili, zooglea, micrococci, microzymes, microphyptes, microbes, microzoaires, entophytes, saprophytes, infusores, contagium corpuscles, particles, &c., &c.

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Washington Lyon's disinfecting apparatus is substantially the same as Dr. Esse's, but the cylinders communicate through a stop-cock. The outer cylinder is first heated by the admission of *saturated* steam with the effect of heating at the same time the inner chamber. The objects to be disinfected are then placed within the chamber and the cover tightly closed by a number of screws, an operation requiring about ten minutes, during which the imprisoned air and the infected objects are getting heated. The stop-cock of communication is now opened and steam of about 260° F. is admitted. If any condensation occurs, provision is made for that being immediately carried off

by drainage pipes. But it is stated that "*the great object of the casing* [*i.e.*, the heated outer cylinder] *is to prevent condensation* of the steam within the chamber, for if such a condition were to arise the object would become wetted." Nevertheless the theory of the maker is that "the steam on coming into contact with the colder infected objects *instantly condenses* upon them until *all are damped and moist*, and when the pressure is removed the *water*, no longer restrained, evaporates, and the objects remain *in an almost dry condition*." M. Vallin, when commenting on this phenomena, says "this is what we do not very well understand," and his difficulty claims sympathy. An eye-witness to the process whose evidence is adduced by the maker says "on opening the door the several articles above named [*i.e.*, various fabrics and a letter in coloured ink] were *to our surprise and satisfaction perfectly dry!*" Now there is here a blowing of hot and of cold, a condensing, a wetting, and a damping conjoined with a provision against condensing, or wetting that needs to be reconciled. My explanation is that the maker's theory—a very pretty one by the way—is altogether based on a fallacy. I feel assured that no condensation of steam can take place unless slight and momentarily at the close of the process when the articles are being removed from the chamber. At the instant when the cover is swung aside there will take place a rush of cold air, a portion of steam will be condensed, and the remainder dissipated. For steam so far from being a moist fluid is *perfectly dry* as long as it retains the elastic force due to its temperature—that is, so long as the temperature does not fall; and in this case the temperature is kept up by the hot outer casing and the continuous supply of hot steam, from beginning till the end of the process. It has been pointed out by a great authority that "steam is of so drying a nature that it cannot be contained in wooden vessels (however well seasoned they may be) without drying them and making them shrink till they crack and fall to pieces. Steam is never moist." When steam is *condensed* it becomes water itself, and the mere removal of pressure will not evaporate water, although it will permit the dispersion of steam when liberated from pressure. If the articles placed in the disinfector under consideration are ever penetrated with steam that has *condensed*, then assuredly they are wetted with water as effectively as if cold water had been poured upon them, and that water will only evaporate under a separate drying operation. If the chamber had been filled only with saturated steam, and if that steam had been isolated from water in a space of fixed dimension, and if the temperature had been permitted to fall, instead of being steadily maintained, there would then have been a certain amount of condensation, although very

trivial because of the little margin of fall that could be possible under the conditions. But the chamber is not filled with saturated steam, but with a mixture of hot air that previously filled the chamber, conjoined with as much moisture from the steam as the air can absorb, viz., about five-eighths of the gross weight of the mixture. The weak points in the theoretical "principle" of this apparatus consists in overlooking the *perfectly dry gaseous nature of steam* while retaining the elastic force due to its temperature, and in applying to a mixture of air and moisture the physical laws applicable to saturated steam.

It must not be supposed that I am disparaging the real efficiency of the apparatus *quantum valeat*—that is as a *dry heat* apparatus. I think it an improvement on those of Dr. Esse's and Dr. Henry, but the quality and action of the heat is precisely the same as in these or any other dry heat appliance where dry heat alone is employed. The penetration of heat will be quicker, because of the pressure, and that is all. But it will lead to a fallacious security if the alleged property of *moist* heat is made the ground for materially shortening the process. I say so much because I am told by an official having charge of the erection and experience of the working of one of these machines, that half-an-hour was a customary period to give to one operation, but that ten minutes would really suffice. Against that belief, and against operations conducted under that belief, I enter a protest and give warning. The duration of exposure should be nearly the same as in any dry air apparatus of the same temperature. Dr. P. Bate, of London, thinks well of this machine after having seen it in action, admitting that "it has the drawback of being more costly than others, together with the necessity of requiring an able and experienced attendant," but he adds, "the rapidity and certainty of a sufficient heat are a sufficient compensation." With regard to the "rapidity," I must lodge this caveat that a furnace must be got into action and a steam boiler be in full delivery before the disinfecting process can be commenced. I had it in view to make an *experimentum crucis* to settle beyond any cavil all question as to the alleged moisture of the heat under which it operates, and with that object I have on two occasions made visits to Belvidere Hospital, in the suburbs, where one of these machines is in course of erection, but it is not yet in readiness, and my intended experiment is delayed.

Dr. CAMERON, M.P., Glasgow, remarked that as Dr. Adams had made reference to a paper of his on this subject he might be permitted to say a very few words on it. He thought there could be

nothing more important than the recognition of the superiority of disinfection by heat over disinfection by disinfectants; the mode of application of the latter being empirical, and the knowledge of their action very rough and ready. He believed that in many cases much more harm than good was done, because the use of disinfectants engendered a confidence they had no right to give. Dr. Adams would have done great service if he had succeeded in making the process of disinfection by heat thoroughly efficacious. Judging, as they must all judge, very crudely by what they heard without illustration, it would seem that he had succeeded in what he had attempted. He had succeeded apparently in burning the germs of disease that might have been removed in clothing and been discharged into the open air. The importance of that might be judged from a circumstance to which great public attention had been directed in London. The spread of smallpox in the neighbourhood of smallpox hospitals could be accounted for in no other way than the dissemination of the smallpox germs in the area surrounding those hospitals. There was just one weak point in this hot air arrangement—that it was impossible entirely by means even of the current of hot air to drive off the spores of the organism of disease which might be harboured in the articles they wished to disinfect. Some interesting experiments, however, had lately been made by M. Chauveau and others on the attenuating power exerted by heat on the microbic organisms of disease which appeared to him to throw considerable light on the practical nature of disinfection by heat. These experiments explained the fact that although spores might still rest on the clothing exposed in the disinfecting chamber, and not altogether deprive them of vitality, still after they had been submitted to the attenuating action of heat they were rendered of no consequence. That, he thought, explained the fact that articles disinfected in those hot chambers were free from all danger of producing disease.

Mr. G. W. Muir, Glasgow, asked Dr. Cameron to explain whether the destruction of germs by flame was superior to the disinfectant that Professor Lister had been so successful with. He could not see how the flame power was to be applied in surgical operations.

Dr. Cameron said no one recognised more fully the ability of Professor Lister than he did, and no one had spoken more unreservedly in acknowledgment of the great merit of his discovery, but it would take too long to explain the question asked. The cases were entirely different, and he would merely recommend Mr. Muir to read Professor Tyndall's paper on "Floating matter in the Air."

Dr. Sutherland quite agreed with Dr. Adams that his disinfecting chamber was capable of destroying the skindrift of infectious diseases and the germs in the clothing and bedding; but he wanted to know whether a heat of 300 degrees was capable of destroying the ova of vermin, which was a great source of trouble in reformatories, poorhouses, and other public institutions. How to thoroughly destroy

these was not yet known. The capsule was very tenacious, and he was not at all sure that a heat of 250° F., would kill the ova—in fact he was afraid that it would so far mature them that contact with the human body would complete the dehiscence of the capsule and the escape of the parasite.

Dr. ADAMS said that had been clearly demonstrated. It had been shown that if the air was a little moist then a heat of 212 degrees was abundantly sufficient for destroying the ova.

Mr. W. R. MAGUIRE, Dublin, said he was an Irishman, but he supposed they would listen to him, even in Glasgow. He had a great deal of experience of disinfecting chambers of this kind, and he would criticise Dr. Adams' chamber in regard to his arrangement for non-conducting. Although Dr. Adams said he relied on air as a better non-conductor than felt, he employed iron back and front plates, and he was therefore obliged to use iron connecting strips, as shown on his plan, to join the inner and outer iron plates rigidly, else these plates would buckle or warp from the heat, and the result was that necessarily these connecting iron strips rapidly conducted heat away from the chamber. Iron was here used with air enclosed: but wool and timber non-conductors would be far better. He was very well acquainted with Dr. Scott's self-regulating disinfecting chambers, which received the Award of Merit from the Sanitary Institute, and are extensively used in England and Ireland. In them the entire heat produced was utilized, while two-thirds was evidently wasted by Dr. Adams' chamber. A patent self-regulator was also attached to Dr. Scott's chamber, which marvellously economised consumption by automatically shutting off the gas as the temperature reached the desired point. The foul infected air was also passed through flame, and all organisms therein utterly destroyed before it escaped. And, finally, Dr. Scott's chambers were made either for coal or gas fuel, so that where there was no gas these chambers were still available. There does not appear, therefore, to be much of desirable novelty in Dr. Adams' chambers; and they will be found to consume much more gas than Dr. Scott's, bulk for bulk; and as to price, of which they had not been informed, as a practical man, he could say that Dr. Scott's chamber would be made for less money.

On "River Pollution," by HENRY ROBINSON, M.Inst.C.E.

WHEN the Rivers Pollution Prevention Act was passed in 1876, hopes were entertained that it would result in stopping the pollution of our rivers. If, however, the working of the Act up to the present time is considered, it must be admitted that it is practically inoperative, and the results that have accrued are

utterly incommensurate with the evils which had to be grappled with.

I consider that no more fitting time or place could be chosen for discussing the working of this Act than at a Congress of the Sanitary Institute of Great Britain held in Glasgow, a city having deep interests at stake in the matter, whether regarded from a manufacturing and commercial, or from a sanitary point of view. The inquiries that have been held with reference to the state of the River Clyde are evidence of the keen interest that exists. The Reports of Messrs. Bateman and Bazalgette in 1868; the Report on the River Clyde pollution dated 1872–1874; the Report of Sir John Hawkshaw in 1876; the more recent Report by the deputation appointed by the Town Council and Board of Police of Glasgow to inquire into the methods of disposing of sewage adopted in various towns in England; and lastly, though equally deserving of acknowledgment, the valuable data collected by Dr. William Wallace, the City Analyst of Glasgow, all furnish information for the guidance both of those who have to decide as to how this town and this river are to be dealt with, as well as of those who are interested in the general question. The Association for Preserving the Rivers and Lochs of Scotland from pollution rendered good service in forming public opinion and in accelerating legislation.

The Rivers Pollution Prevention Act was passed to meet the well founded demand for such legislation as would prevent the injury and pollution of rivers by the discharge into them of refuse, putrid solid matter, or other waste or noxious or polluting liquid or solid sewage matter. The Act deals with the evils under three heads—1. Solid matters. 2. Sewage pollution. 3. Manufacturing and mining pollution. The prohibition as to putting solid matters into rivers is absolute. The prohibition as to the discharge of sewage or poisonous noxious polluting liquids from manufactories or mines into rivers, is accompanied by the proviso, that no offence shall be deemed to have been committed where the fluid is conveyed by a channel used, constructed, or in process of construction at the passing of the Act, if the best practicable and available (or reasonably available) means has been used to render harmless the sewage matter or polluting liquids so passing into the river.

Power is given to the Local Government Board to grant further time for a local authority to adopt the best practicable and available means, and to grant Certificates where these means have been adopted.

To put into operation this Act a sanitary authority may (the Act, be it observed, is permissive, and not compulsory) take

proceedings against an offending mine owner or manufacturer, for discharging liquid pollution or solid refuse, or an aggrieved person may compel a sanitary authority to move in the matter, by application to the Local Government Board. An aggrieved person can also put in motion the Act against a local authority for discharging sewage into a river. The County Court of the district in which the offence is committed is the tribunal before which the case is taken in the first instance.

In August, 1877 (when the Act came into operation) the Local Government Board issued a circular to the Sanitary Authorities throughout the country, bringing to their notice in very clear terms the provisions of the Act, with the view to their being put into operation.

It cannot be said that this Act was in advance of public opinion, inasmuch as there was a universal agreement as to the necessity for legislation on the subject. Neither can it be said that the Act was too stringent. Indeed, criticism was rather in the direction of its being too lenient, but it would have been undesirable for any legislation to have erred on the side of excessive stringency, as this would have led to its being defied as unreasonable, or, to its being disregarded, as incapable of being enforced.

Now this Act, mild as its provisions undoubtedly are, has been in operation long enough to enable an opinion to be pronounced as to whether or not it has accomplished, or is likely to accomplish, that which was anticipated. I am of opinion that it has not, and that practically it is a dead letter, and that unless it is amended it will remain inoperative. I do not go so far as to say that it has been a useless piece of legislation. It served for a time as a rod to be held over individuals and local authorities who were offenders, and to some small extent it caused enquiry and action where indifference had previously existed. The total effect, however, is inappreciable. The rivers continue as before to receive the pollutions which were sought to be abated. Not one certificate has been given to a town that the best practicable method has been employed to remove polluting sewage matter, although there are hundreds of towns offending against the Act which could be prevented from offending by adopting well recognized methods of dealing with their sewage were they stimulated to do so.

Although my own professional experience lies more in the direction of the operations of the Act in regard to sewage pollution, I believe it is a fact that the Act is inoperative in regard to pollution from mining and manufacturing refuse.

The exact amount of good which has resulted will shortly be

ascertained when the returns which were moved for by the Duke of Northumberland last session are issued.

As the prevention of the pollution of our rivers was considered (and very properly so) sufficiently important in 1876 to secure special legislation, and as that legislation is not producing the anticipated results, it is most desirable to consider the causes of this failure, and of eliciting opinions with the view of arriving at what alterations are necessary to ensure the attainment of the objects contemplated.

One difficulty which existed at the time this Act was being shaped has disappeared, inasmuch as the methods of dealing with sewage are now well understood, and have ceased to be the bone of contention amongst interested patentees of chemical systems or of enthusiasts who looked to realizing fortunes by irrigation. Therefore, in interpreting the expression, "the best practicable and available means," I am confident that an impartial expert in sewage disposal would now be able to advise without any difficulty as to the proper and suitable system and works for each case.

The interpretation of this important expression might advantageously be explained in any future Act, so as to indicate the standard of purity which will be admissable, and to prevent its being considered that it is intended to require a uniform standard in all cases which would be both undesirable and impracticable to enforce, as any attempt to compel the adoption of an equally high standard in all cases would lead to failure. It would be unreasonable to require the effluent from sewage disposal works which discharge into a tidal river, or into a river like the Thames below the water companies' intakes to be as pure as should be required where the effluent passes into a small rivulet, or into a river above intakes of water works.

It appears to me that one serious defect in the Act which has contributed as much as anything else to its being inoperative is this:—The onus of initiating proceedings against offending persons or authorities is largely cast upon the individual riparian, or other, owner, which involves the assumption that such individual is able and willing to undertake the duty of enforcing the Act, or where the sanitary authority is relied on to enforce the Act, it presupposes that it will move in the matter, whereas in regard to sewage pollution, the authority itself is the offender. I may illustrate this by referring to a recent case, which is one of the few that have been tried under this Act, and as I was personally engaged in enforcing the Act against the Local Board, I am familiar with the facts. The sanitary authority of a town had, in a fitful way, and for years considered whether or no their town should be properly sewered, and the

sewage properly disposed of instead of its continuing, as it did, to pollute the beautiful river which passed through the town, by discharging sewage matter into it from several old ditches and drains. This state of things would have continued but for the action of a powerful riparian owner who had both the will and the means to fight this Board, and who determined to put in motion this Act. He succeeded in these proceedings, and obtained a decision against the authority, which will result eventually in the pollution of the river being stopped.

This was not a very flagrant case inasmuch as the whole sewage of the town was not passing into the stream. Yet it constitutes one of the very few cases where a riparian owner has moved in the matter.

I think that the burthen of enforcing the Act should not lie with individuals or local authorities alone, as if the question were purely local. It is a public grievance which was sought to be removed by the Act, and requires to be treated in a broader manner than has been done. Individuals taking the initiative (as in the case I have referred to) are placed in a false and invidious position, as their action may prejudice them in the eyes of their neighbours who may fail to appreciate the motives actuating them. I am quite satisfied that the machinery devised by the Act will continue to be incapable of overcoming its own *vis inertia*.

In my opinion an alteration in the Act is imperatively called for, and I suggest as a necessary change that the initiation of proceedings under the Act should be entrusted (in addition to the authorities and individuals) to public inspectors who should be entirely independent of local authorities, and who should be responsible to a Department of State. These officers should have power to enter premises to examine into cases of pollution and to report to head quarters. The Department, after considering the facts stated in the report, could take action or not. The establishment of such a *modus vivendi* would secure the co-operation of the public, and the existence of causes of pollution would soon be made known voluntarily by residents and others who would be unable or unwilling to enter upon the tedious, costly, and uncertain course of procedure under the Rivers Pollution Prevention Act.

Professor ROBINSON wished to say before the discussion was entered upon that he was very much tempted when he wrote the paper to make some reference to the question of the purification of the Clyde. But his object was to procure consideration of the

Rivers Pollution Prevention Act. Whilst the question of the Clyde was a large one, he felt he would be following the wisest course and meeting the wishes of the Institute if he treated the matter generally. Besides, without data, his opinion on the subject would be without value. As the question of sewage disposal was referred to by the president and Dr. Carpenter, in connection with a previous paper, he wished to say that the suggestion made by the latter, that sewage should be disposed upon land, was one which required consideration as to the area of land that could be obtained. The disposal of the sewage of Glasgow upon land was impracticable, owing to the enormous area which would be required.

The discussion was opened by—

Mr. W. C. Sillar (London), who said they were all much indebted to Professor Robinson for calling the attention of the Congress to so decided a defect in the legislation intended to put a stop to river pollution. And the task could not have been entrusted to abler hands, for Prof. Robinson, as an engineer, was thoroughly acquainted with the subject in all its branches, and must be considered an expert in the matter of remedying the evil on account of the long and earnest study he had given to the subject, and the experience inseparable from such a study. Prof. Robinson did not propose more legislation, and in that all sensible people must think him right. What he wished to remove now was not the pollution of the rivers, but the inaction or inactivity of those persons who alone possessed the power of putting the legislative Acts in force, and he was right in attributing the existence of this inaction to the unwillingness of riparian owners to incur the unpopularity of originating a movement which was to affect the purse-strings of the ratepayers. Now, it surely was patent to everybody that, whatever odium or unpopularity might attach to an independent riparian owner who was in no way answerable to the ratepayers, but, on the contrary, was one himself, an immeasurably greater amount of it would rest upon any member of a corporate body who imposed an additional burden upon the men who elected him, and that voluntarily and without any outside pressure. Therefore the pressure proposed to be put upon town authorities was one to which they could not reasonably object, for it furnished their justification for increasing the rates. He (Mr. Sillar) spoke from a standpoint by no means disinterested, for he had laboured long and earnestly to perfect a system of water purification, and though it did not become him to declare it to be the best practical method, he conscientiously believed it to be so. On many former occasions he had had the privilege of explaining before that and other Congresses the principles of the system so successful at Aylesbury, but upon the present occasion he had the greater privilege of speaking of facts accomplished instead of excellences expected. For seven or eight years the Native Guano Company had received from the authorities of Aylesbury a unanimous and annual expression of perfect satisfaction with the system. The Congress heard the day before yesterday

a sad account of the deficiencies of Southport. It could not be otherwise. Sewage *per se* was not intolerably offensive until it had been decomposed. So there was an evident advantage in the treatment of it being as speedy as possible. The necessity of long and expensive sewers only existed for the purpose of removing from the neighbourhood of dwellings the offensive sewage works. But as the Aylesbury process was not offensive that necessity did not exist. That the process was not offensive might, he thought, be fairly inferred from the fact that a working model upon real sewage had been exhibited in constant operation at the International Fisheries Exhibition for some months, where any offence would not for a moment be tolerated. It had been visited by thousands, including His Royal Highness the Prince of Wales, who personally expressed his approbation of the process, and who had sanctioned it adoption at Wellington College, of which he was the president. It was not his (Mr. Sillar's) intention of unduly occupying the attention of this Congress in saying what had been often said before. Let it suffice to say that the A B C process had for years effected a sufficient, and more than sufficient, purification. Secondly, the operation required little space, and caused no offence; and thirdly, the manurial wealth was preserved for agriculture, and was so fully recognised as valuable that the farmers bought it, and would buy more if they had more to sell. Dr. Carpenter, whose account of the Croydon farm they had heard, would excuse him if he said that such wealth as existed in sewage was more economically applied to the general agriculture of the country than confined to the limited area of a sewage farm.

Mr. G. J. Symons, F.R.S., pointed out that if they insisted upon the Act in its integrity our manufacturers might be worsted in their competition with foreign manufacturers. If it could be shown that a river could be kept absolutely sweet and pure without crippling the manufacturers, then let it be made as sweet as possible. But rivers would require to be treated differently. The Irwell would require to be treated in a way different from the Tay. The former was black as ink, but the latter contained tens of thousands of salmon. On the other hand, the Thames and Clyde would require intermediate treatment, for they were used for both pleasure and commerce. No one would go upon the Irwell for pleasure. In all these matters there should be as much amelioration as possible. The Institute must not aim too high in this matter. They must not aim at a point where the great bulk of the common-sense of the country would not go with them. What they must do was to go as fast as, and perhaps just a little ahead of, the ordinary commonsense of the country, but they must not aim at theoretical perfection. He was glad that the President of the Institute (the Duke of Northumberland) had taken a step in the matter. As it was, the "Local Authority" was often the people who ought to proceed against themselves—which was the last thing they would do. The responsibility of stopping a nuisance was sometimes thrown upon the individual. Now an individual did not like to come forward and annoy

all his neighbours. He thought it would be better, as had been suggested, that inspectors should be appointed entirely independent of local influence.

Dr. W. Wallace, Glasgow, thought it would be a great benefit if there was a system of inspection with regard to rivers pollution such as there was for Alkali works. These works at one time annoyed the inhabitants and destroyed vegetation, but legislation had been brought to bear upon them and a great improvement effected. Besides, the owners had been able in consequence to utilise some of the refuse which was at one time offensive. Now, if legislation were applied more sharply than at present in respect of river pollution, a similar improvement would be effected. In Glasgow a great deal of attention had been devoted to the subject of river pollution, and although they had not yet done anything in regard to the Clyde, still they were in a position that when they were forced to do something they would be enabled to go into a satisfactory scheme. The position they took up was this, that in the first place, as regards manufacturers' refuse, no solid matter of any kind should be allowed to go into the sewer from the factory, and in the second place, that no acid should be allowed to enter it. They held that manufacturers should treat their acid refuse in such a way as to run it off in a clear state and slightly alkaline, or at least, free from acidity. Then it would do no harm to the sewage. No scheme of precipitation had yet been fixed upon; but they thought that precipitation was the most likely thing to adopt for Glasgow. They could not adopt a system of irrigation. He knew the sewage farm at Croydon, and he considered it a great success. But that success depended upon peculiar circumstances whice did not exist in Glasgow. In the first place, they had not got the quantity of land required, nor the kind of land. If they treated their sewage by irrigation, they would require ten square miles. Now they could not get that, indeed he did not think there were 100 acres suitable for the purpose. As regards the schemes of precipitation, these also depended upon the situation. He had seen the A B C process to which reference had been made, and he considered it very suitable for Aylesbury, but it would be absurd to adopt it for Glasgow. For a small town it was an excellent process, but other processes were more suitable for larger towns. If Glasgow adopted a scheme by precipitation, it would in the first instance try lime simply.

Mr. G. W. Muir said that he had some experience of Government inspection lately, and he did not like it. He would rather that it should be a local inspector, who should be placed above the influences of the Local Board. But when he was deemed entitled to an advance of salary he should apply for it not to the Local Board but to the Government Board in London or Edinburgh. He also objected to Prof. Robinson's proposal to treat different streams in different ways. All the difficulty would be removed if they said, "We will not allow anyone to pollute a stream at all." They had a scheme for the puri-

fication of the Clyde four years ago; but he had reason to believe they had now a better scheme. The great mischief in Glasgow was that, being a large city, they would require immense works. But they could have the works within Glasgow itself, and there would be no necessity for gigantic sewers. He believed that sewage works could be carried on in any town without offence to the sight or smell. In Bradford the sewage works were in the best part of the town. Therefore the way was easy if the Local Boards would make up their minds to do their duty. If they did not do it, the Government should.

Mr. W. R. W. SMITH, said the question for the Congress to discuss was whether they should seek so to alter the Act as to benefit riparian landowners purely at the expense of the community. If Prof. Robinson had suggested in his paper that every riparian owner who was benefited by the purification of the river which passed his property should pay a large part of the cost of that work, then and then only would he have said there would be some justice in seeking further legislation. While he would like to see their rivers purified, he was afraid that it would be a long, long time before the general provisions were carried out, whereby the various Local Authorities should be compelled, at the public expense, to purify the rivers, unless landowners were obliged to pay a certain amount for the benefit which would thus be conferred upon them. He said, "I considered rivers were common property, being the arterial drains of the country." Mr. Smith further pointed out that it had yet to be proved, so far as the Clyde was concerned, that the public had derived any bad health from its foul condition. Besides, while they were badly off in Glasgow as regards the condition of their river, they were nothing like so badly off as the people residing on the banks of some of the rivers in Yorkshire. About a river in Yorkshire it was said that a petition sent up for its purification was written with water from the river itself.

Ex-Bailie SALMON, ARCHITECT, Glasgow, argued as long as the present mistaken water-closet system existed, no ingenuity—every scheme in that direction having been exhausted—can prevent the pollution of the running waters of the kingdom from the rivulets to the rivers. What he would like to impress upon the nation was that we are by this system bartering the health, wealth, beauty, and water carriage necessities of the kingdom for an unattainable chimera. To undertake the task of providing water-closets that will poison neither the water nor the air we must begin by conquering the laws of nature. The present water-closet system, while dangerous to every householder, is peculiarly so to the industrial classes, numbering at least 20,000,000 of the population. The water-closets introduced into these houses are in themselves cheap and imperfect, and made still more injurious by ignorance or carelessness of the householders until not unfrequeptly even their habitations become traps for disease. With regard again to the serious interruption and expenditure with which the system burdens the upholders of our navigable river, we

have only to obtain information from the respective authorities to learn that thousands and thousands are expended from year to year to remove part of the poisonous sludge from the river so as to keep navigation open. The speaker at the same time, after a very long experience, asserts that there is no difficulty in providing closet accommodation suitable for every rank of life, and on such a principle as to keep the rivers in the hands of nature and our towns and cities undefiled. And in reference to the agriculture of the kingdom, the late Mr. Mechi, acknowleged to be our highest authority in such matters, in a letter to the *Times*, declared that if the misapplied manure which is at present producing so much evil throughout the nation was carried to the agricultural districts, the food production for the people would be doubled. In that same letter Mr. Mechi expressed in strong terms his wonder that neither Architects nor Engineers had overcome the difficulty, if there was one. But the difficulty is overcome and only waits the dictum of our Rulers to make its observance imperative.

Dr. DUNCAN, Crosshill, urged that there should be a distinction drawn between tidal parts of rivers from which no one thought of taking a water supply, and the rivers or parts of rivers which might supply the communities living on their banks with drinking water. He further urged that the entrance of sewage matter into rivers which provided water supply to the people should be summarily put a stop to, and stated that in the present state of the law persons might pollute any public river in Scotland with sewage matter with perfect impunity. There must therefore be a change in the law of Scotland. In such cases as cholera and typhoid fever they found that the excreta of these diseases might pass for considerable distances along water-courses and yet not be robbed of their terror. He could point to hundreds of instances in which one or two typhoid stools entering a small stream had produced great epidemics at considerable distances from the point at which they entered the stream. Consequently such views as had been advocated by some, that the mere fact of the excreta passing through the current of the river and being exposed to oxygen robbed them of their danger, were entirely at variance with the facts of medical science. As far as they knew at the present moment the germs which produced these diseases were solid, and probably living particles, and they did not know that any system of precipitation applied to sewage prevented them from exercising their noxious influence. The only system as far as he was aware that had yet been proposed which prevented such materials as typhoid and cholera excreta from exercising their dangerous influence, was the system of the Messrs. Fryer of Nottingham, which subjected them to a high temperature. There was no doubt whatever that it would be a very important thing if all the sewage of the community could be returned to the soil; but if the sewage were to be returned to the soil at the expense of poisoning the inhabitants all round the district in which it was placed, it would be a very serious matter indeed, and would require a great deal more con-

sideration than had up to the present time been given to it. If the sewage was to be returned to the soil, it should be spread over lands which were not in the neighbourhood of districts which supplied the community with water. In Glasgow the sewage precipitation which had been suggested by the authorities was, in his opinion, the best scheme for the public, because the River Clyde at Glasgow is a tidal river and is not used as a water supply for the inhabitants on its banks.

The PRESIDENT (Dr. Angus Smith) said it was a little alarming to hear that the Rivers Pollution Prevention Act, which had cost him considerable labour had been of no use at all. He thought they had made a fair beginning. The inspectors had no power to initiate a prosecution; they could not go to any river or brook and say to any individual, "You shall not pollute," but the initiative must be taken either by the local boards or by individuals, or, in other words, by the public. If little had been done, it was the fault of the public, and although the Act had not done a great deal, it had not been inoperative. There had been several trials consequent upon complaints, and more or less action had been taken. Professor Robinson had said that not one certificate had been given under the Act.

Professor ROBINSON: The sewage part of the Act.

The PRESIDENT (Dr. Angus Smith) said he would use the words "under the whole Act." Applications had been made for a certificate, but he had uniformly refused to give any, the reason being that the Act demanded the best method. Now, he could not say that in any case the best method had been put before him. Professor Robinson considered there could be no doubt as to what was the best method, and that a law might be readily framed; but as soon as he had said that, three, four, or five gentlemen rose up, and each had a different method. Now, which would be the best? He still felt justified in doing what he had done. He would still refuse any certificate unless the words of the Act were somewhat altered. That was the only thing he objected to in the Act; it was too stringent in the use of these words. At the same time, it was exceedingly difficult to alter the words without bringing in some considerable objection. A distinguished sanitarian had said it would be impossible to purify the rivers unless we used the whole army of Great Britain. We might almost agree to this. But he differed very much from those gentlemen who supposed this must be done by legislation alone. He considered what was wanted was invention more than legislation. The Rivers Pollution Prevention Act brought to bear a slight pressure upon the community, and this pressure was causing manufacturers and others to promote invention and avoid pouring refuse into the rivers. Although no invention had been made compulsory, manufacturers had been quietly moving in various parts of the country, and what had taken place at Galasheils was a most important proof, so far as Scotland was concerned; for, had it not been for the Act, the

improvement in that district would not have been carried out. The same thing might be applied to other places. He considered, therefore, that the value of the Act had been by a slight pressure, not a violent one, to cause improvement in the direction of invention, which, so far, had been successful.

Professor ROBINSON replied that he quite agreed with what the President had just said as to the inspectors having no power of initiation; in fact it was the very thing that he thought required dealing with. He could not, however, agree with what the President said that the action which had been taken could be regarded as a fair beginning. It was so trifling in its degree that it ought to be characterized as inappreciable. With respect to what had fallen from other speakers he considered that useful opinions had been elicited. He would reply to the speaker who objected to riparian owners having the streams purified without paying for it that it was quite reasonable to deal with the question of cost on an equitable basis, so that all classes should contribute. He did not propose to meet the suggestion to discard the water closet system or several other points which were touched on, but which time did not admit of dealing with. As regards Mr. Sillar's remarks, he would observe that although the A B C system produced a successful sanitary result at Aylesbury he was not prepared to recommend it for Glasgow. He said this with a full appreciation of the labours of Mr. Sillar and his fellow workers. Parliament had clearly intended that a certain end should be attained by passing the Rivers Pollution Prevention Act. This end, however, not having been attained, and the condition of things remaining which called for, and resulted in, legislative interference, he was fully persuaded that an impetus should be given by which so unsatisfactory a state of affairs would be removed. In conclusion Prof. Robinson thanked those who had spoken, and also the President, for having contributed to the discussion.

On "Smoke Abatement," by W. R. E. COLES.

IN the presidential address of Captain Douglas Galton at the Congress held last year at Newcastle-on-Tyne, he reviewed in detail the influences of town atmosphere on health, and proved by carefully prepared statements that in twenty-three towns selected for their smokiness, the mortality from diseases of the respiratory organs was largely in excess of the average, and from diseases of the zymotic class, the mortality was more than double that of the rural districts. At the same meeting the suggestive papers of Mr. Ralph Carr Ellison and Dr. B. W.

Richardson treated of those social evils directly begotten of a darkened and polluted atmosphere, say lowered tastes and moral tone, craving for stimulants induced by lowered vitality, debasement of the poorer classes, especially, from the influences of unavoidably dirty homes and persons.

The efforts thus put forth at Newcastle-on-Tyne by the Sanitary Institute are noteworthy, for they have met with sound and promising success. Not only have various private individuals and commercial firms been stimulated to lessen the production of smoke in their particular cases by adopting improved heating apparatus, but the town authorities have been so influenced by public opinion and personal conviction that within the past fortnight it is reported that they have completed the substitution of improved furnaces to abate smoke at some of the Corporation works, which formerly produced a great deal of smoke, and simultaneously with setting so good a public example, they have decided to issue a circular calling upon owners of steam vessels on the Tyne and all manufacturers to abate smoke to the lowest possible point. But though it has thus chanced that the Sanitary Institute have so far moved in other centres than this in the cause of smoke abatement, it is at the present Congress in the great city of Glasgow that the Council have authorized the *first* paper on smoke abatement to be submitted for consideration as a separate branch or department of sanitary science.

Nothing, I venture to think, can be sounder in policy than this decision on the part of the Institute, for the magnitude of the evil, as well as its peculiar character, alike mark it out for separate recognition and distinct treatment at the hands of the legislature, local authorities, sanitary, medical, scientific and other professional and non-professional classes of the community. As a separate sanitary work none can transcend that which aims at, and is capable of, securing for the inhabitants of towns more of those vital and vitalising elements—sunlight and respirable air—than they now possess; and while thus occupying an unique and defined position in the department of sanitary science, and standing as an indispensable ally to that science as well as to every other effort aiming at amelioration of the physical and moral conditions of town life, the smoke abatement cause has other, yet wider and special claims of a social and economical character upon the attention of public bodies and private individuals.

It seems unnecessary to deal *separately* with either the sanitary or the social aspect of the smoke question at this time. The sanitary side of the subject has already been treated in detail by Captain Douglas Galton in the address I have alluded

to; and others (among whom I may mention Mr. Ernest Hart) have statistically shown the largely increased mortality to be fairly ascribed to a smoky atmosphere. Medical opinion is virtually unanimous on the subject. Sir William Gull, Dr. Andrew Clark, Dr. Alfred Carpenter, Sir Spencer Wells, and other eminent private practitioners, have publicly expressed their warm support; while from the other branch of the medical profession—the Medical Officers of Health—equally strong sympathy has been evinced. Dr. Tripe and Dr. Wynter Blyth were among the earliest members of the Smoke Abatement Committee, and from that time, and the earliest reports of Dr. Sedgwick Saunders to the Corporation of the City of London, down to the recently published report of Dr. Leigh of Manchester, the support of the Medical Officers of Health has been strongly expressed in favour of smoke abatement. Sir Henry Thompson has stated that "the influences of sunlight, imperceptible as they may seem to us, are almost as necessary as the food we eat."

The Sanitary Institute, the National Health Society, and other Sanitary bodies, strongly urge the necessity for smoke abatement. Thus the evidence on this side of the case seems practically as strong as it can be; while on the question of there being *moral* reasons for purifying the atmosphere, I don't think stronger evidence need be adduced than that given by Mr. Ellison and Dr. Richardson in the papers to which I have referred. I may perhaps mention a practical consideration advanced by Mr. T. C. Horsfall, of Manchester, namely, that one great evil of smoke is that it drives many of the upper and middle classes who can do so, to live out of town, and thus cut off their association with town affairs, and their influence for good upon the poorer members of the community.

In view of these separate branches of the subject being thus so well authenticated and generally understood, it seems desirable to consider *other* general features of the case, and more particularly the actual *cause of the evil*, and the *probability of its abatement*.

As smoke is but the expression of defective heating processes, by its production these processes stand condemned. They must be improved. We must face the true issue. The production and application of heat must become raised to the level of a recognised and rewarded art and industry, before the ultimate success of the smoke abatement cause can ensue. The very term "Smoke abatement," is, in a sense misleading, for it points but to an *expression* of evil—not to its *cause*. "Heat cultivation" would more correctly indicate the underlying and governing principle on which thought and action must be based if we

would intelligently address ourselves to rid the atmosphere of smoke and secure the advantages attaching to that great object. When we remember that heat agency lies at the root, and more or less intimately affects almost every civilized art, we see how large is the field for useful reform which opens before us.

In a broad sense it has hitherto been, and still is, the practice to obtain heat merely by heaping crude coal on a fire, regarding little the true character of the fuel, the apparatus in which it burns, or the duty actually required. So long as there is heat enough for the purpose in view that is deemed sufficient; the strictly exact and beautiful natural process called "combustion" will not submit to such usage, and it punishes man in purse and in person to teach him to use his intelligence and amend his ways. These are but elementary truths, and trite ones to many, but this Congress cannot, I think, ignore them while it remains an urgent and essential necessity to sanitary progress that public attention should be thus directed to consider "first principles," in order to judge aright the true cause of, and true remedy for, the ills now suffered. Hitherto, as we know the smoke question has been treated either slightingly or in a disponding or impatient spirit, perhaps the term "nuisance" has had much to do with this. It does not suggest the true idea that smoke production, in the sense we know it, is a grave national calamity, calling for the voice and effort of the nation to contend against. The word "nuisance" conveys, or has grown to convey, something of the kind known as "annoyance," something which must either be borne as inevitable, or be avoided by forcible measures. In this case, the force of sharp legislation has been tried both in modern and ancient times. In 1306, Edward I. decreed, by royal proclamation, that the buildings from which smoke issued should be pulled down! In 1855, Lord Palmerston, then prime minister, proposed the more practical, but still inadequate measure, that "a thumping fine," as he is reported to have expressed it, should be inflicted; and the law was amended. But although the legislation has undoubtedly effected considerable good by forcing a certain number of persons to yield to public necessity and abate smoke, still it is obvious that legislation has failed, and must fail, of its ultimate object so long as it is limited to its present scope and application. Beyond all, however, legislation far in advance of general public opinion cannot, as we know, be practically operative, however really beneficial its character may be. Although it may be expedient to hold public enquiry into the smoke abatement question by a Royal Commission as has been proposed, to consider immediate extension and amendments of existing laws for the suppression of smoke in view of the various changes

which have occurred since their enactment, still it seems to me that the great aim of those who seek to advance the cause of smoke abatement should be much more directed to awakening and stimulating general public interest on the grounds I have alluded to than to discussing legislative remedies or particular methods of smoke prevention.

It is frequently urged that local authorities are at fault in not enforcing laws in restraint of smoke. Doubtless there is some foundation for this charge, and also force in the complaint so frequently made that those who are called on to administer the law are themselves offenders against it. But these complaints often take the place of the practical consideration of how the state of things is to be improved. It seems overlooked that those who administer the laws are not likely, as a rule, at any rate, to see the smoke question in a different light to that in which the general public view it. Their minds, like those of others, must be opened to the desirability and practicability of reform; but perhaps of all things pertaining to legislative reform, the greatest barrier to its advancement is the manifestly unfair basis on which smoke law has hitherto always stood, namely—that it has been levelled against *certain* trading classes of the community only! Besides this unfairness, there is, too, an impractibility about such legislation which must strike everyone who considers it—How can it be reasonably expected that masters or men who are accustomed to unlimited production of smoke in their own and neighbours' houses and elsewhere, should be imbued with any special views as to the necessity for absolutely preventing smoke in their works? As a rule they look upon the smoke laws as an irksome and unfair restriction on trade; and so long as they can by any means avoid penalties, they practically do no more to advance the object of the legislation.

It seems to have been generally accepted in the past and to remain now a fixed idea, that the smoke from Domestic chimneys cannot be checked or dealt with at all by legislation. Must this view be held as absolutely correct now—and to apply as well to all future time? It would be wholly unreasonable to consider even the possibility of passing an immediate law to absolutely restrain smoke from private houses now existing. Were it even to be passed it manifestly could not be administered. For, as the late Home Secretary (now Lord Aberdare), said in a speech on the subject, "It would be impossible to draw an indictment against a whole people;" but as he went on to say, "Supposing it can be shown that grates as cheap or cheaper than the present ones have been invented and could be applied, and that the result of using them would be an economy of fuel, we have then to consider whether the foundation has

not been laid for the gradual application of compulsion." Surely these words of his are worthy of consideration. In the case of *new* houses, at any rate, a great check might readily be imposed by the united forces of public opinion and suitably restrictive legislation.

The Government have set the example in the abatement of smoke by announcing that tenders for the new Admiralty and War Offices must provide for most improved heating arrangements.

I do not know the annual rate of increase of new houses in Glasgow, but in London, in 1881, it was 26,170, or at the rate of about three new houses an *hour* for every hour of the year! In some other cities it has been proportionately as great. When we realize this enormous extension of new buildings, all with more or less defective heating apparatus, and what they are constantly doing to *increase* the smokiness of the atmosphere and swell the attendant evils of the vicious system which the smoke indicates, is it not our national duty, as well as our individual interest, to join the cause of smoke abatement? Unlike other great sanitary and social reforms, the desired relief will not have to be purchased by the expenditure of large sums of public money involving increased taxation; on the contrary, this reform may be wrought out gradually as, in the strictest sense, one of economical advantage to the present as well as to future generations.

Regarding the possibility of carrying out the reform in a thorough and practical way, we may be encouraged by the success which has already followed the efforts put forth. It would not be practicable to enter into details here nor expedient to refer to particular instances, but it may be accepted as a fact, that the attention which has been directed to the subject has resulted in a large extension of knowledge and marked improvements in all classes of heating apparatus. It is generally admitted that our heating processes are, for the most part, primitive and unsatisfactory, and that cheaper, less cumbersome, and more readily manipulated methods of applying heat are becoming more and more essential in all domestic and industrial operations.

The Official Reports of the Smoke Abatement Committees of London and Manchester are highly instructive and suggestive. They afford a comprehensive view of the character and efficiency of the best kinds of heating apparatus now available, and show the margin for improvements. For instance, it is shown that some domestic grates burn three times as much coal as others do, and produce six times more smoke; that some gas stoves burn nearly three times more gas than other stoves, and that some steam boiler furnaces burn more than twice as

much coal as others for equal work; and that while some produce a great deal of smoke, others are practically smokeless. It is very important to notice that all the tests made were conducted under the superintendence of persons interested in the success of their particular apparatus, and therefore the results recorded by the Committees would undoubtedly show a higher range of efficiency than would be obtained in ordinary use by the public.

Mr. D. K. Clark, M.Inst.C.E., formerly of Glasgow, and well known for his elaboration of the works of the late Mr. Charles Wye Williams and his own, on "Fuel Economy," states, in his report to the Committee, that the tests of open grates showed that only 42 per cent. on the average of the heating power of the coal consumed was utilized in warming the room. Professor W. Chandler Roberts, F.R.S., made a series of valuable and novel experiments to determine the composition of the gases or "smoke" given off from the chimneys, and ascertained that for one part of solid carbon, the blackening constituent of smoke, five parts of invisible but combustible gases (hydro carbons and carbonic oxide) are discharged into the air. By the aid of these reports, the economic as well as the sanitary bearing of the smoke question is presented to our minds with some definiteness — a basis is thus established for future investigations and action.

Hitherto there has been no *general* treatment of the smoke question, nor any point to which interest in it might converge. A general complaint has been made against smoke, but no organized effort has been made to advance general knowledge on the subject, and ally public sympathy and public efforts together to abate the evil in the common interest.

The future progress of the cause must, of course, depend mainly on the *extent* to which the public interest is awakened to recognition of the necessity and desirability of change, and to the *time* at which this influence is brought to bear. If the public support is favourable and prompt to extend the movement now in active existence, scientific minds and commercial interests will naturally be stimulated to continue efforts in an increasing ratio to supply public demand.

As one practical illustration of the speed and soundness with which these forces operate in the present day, I may mention that in connection with an important series of competitive tests of gas cooking and heating stoves, now being carried on in London under the auspices of the Smoke Abatement Institution, it has been found that the character of the apparatus has actually been improved in several instances since the testing was commenced in the spring of the year. Improvements have been

suggested to the minds of designers and manufacturers, and they have actually brought forward modifications of their own original apparatus for competitive tests. That considerable improvement has taken place in gas apparatus has been specially noticed in a recent Report by the Smoke Abatement Institution, and it has been stated at some of the meetings of the Gas Companies that a very large increase in the demand for gas for heating purposes has arisen. So far as the use of gas can be made available for reduction of smoke at Glasgow there is an encouraging prospect, for the name of Mr. Foulis stands high in the gas world as an admirable manager of gas works; and under his scientifie development of gas manufacture, the well known system of Heating the Retorts, invented by Sir William Siemens, has been introduced on a larger scale than at any gas works in the kingdom. Moreover, the coal of the country is suited to gas making, and the manufacturers of gas apparatus in Glasgow are among the largest—if not actually the largest—in the kingdom.

I find I have already extended this paper beyond the prescribed limits, and must somewhat hastily conclude it. I may, however, be permitted to mention that the review of heating systems has already led to the discovery or recognition of various collateral advantages being associated with changes tending to the prevention of smoke. Among them may be mentioned that, in the manufacture of coke, a saving of several millions sterling could be effected by the collection and condensation of the volatile constituents of coal, now poured into the atmosphere in the form of smoke; the development of furnaces suited to utilizing inferior coal and gaseous fuel, and the introduction of appliances for labour saving. The important bearings of these several things on the commercial as well as social interests of the country are obvious, and at the present meeting of this Congress it is not too much to hope that they will find appropriate recognition and development, and that the work of this Section, presided over by Dr. Angus Smith, will, by introducing the subject of smoke abatement, have aided, in some degree, to fulfil the hopes with which he wrote his well-known "Contributions to the Beginnings of a Chemical Climatology," and that the atmosphere of Glasgow may became purer, and its inhabitants richer, by abating smoke which, as Sir William Siemens has expressed it, "always indicates waste."

Mr. C. J. Henderson (Edinburgh) described his new patent stove, which being covered, within a few inches, with sheet tin, induced a current of outside air to pass in between the metals by openings

in front, the temperature of which would be 8 to 10 times increased on issuing by carrying off the molecules of heat as they came to the surface of the iron.

Mr. G. W. MUIR (Glasgow) contended that, in the desire to abate the smoke nuisance from furnaces, the public had relied upon inventions when dimensions were of greater importance. No furnace used for steam raising should emit smoke if the draft was strong enough to raise steam without forcing the fire.

Dr. CARPENTER agreed with the statement that there was no reason why the chimneys of manufactories should send out smoke. It was a matter which the people themselves could settle. He was glad to see from the newspapers that the authorities of Glasgow had commenced to take proceedings against the offenders. In London no manufacturer would dare to send out smoke, because he would be pounced upon at once by the police and prosecuted. Indeed, he never saw a chimney in London sending out smoke in the way he had seen them doing in Glasgow; but the police of Glasgow were the servants of the offenders. With regard to domestic chimneys, there was a difference of opinion. It was quite certain that a local authority could not indict the whole people, and therefore he would press on the Congress a point that he pressed on the Society of Arts three years ago, but which did not meet with much favour. Still, he considered it was the right one. The large proportion of smoke in large towns—and this interested not Glasgow alone, but also all large towns as well as London, which, from its large extent, was becoming a forest of houses, or, as one gentleman had called it, a desert of houses—tended to produce fogs, and he believed these were sometimes even more dense in London than they were in Glasgow. How was that dangerous result to be done away with? His impression was that if the Legislature gave the Local Authority power to license chimneys to discharge smoke into the atmosphere, and let the produce of the licenses be collected by the Local Authority for the purpose of reducing the cost of sanitary operation in the district, he thought they would soon find the smoke nuisance would be very materially abated, the cost of the license being considerable. They would also find that the appliances which science had brought out, such as stoves and warming apparatus, would, by their increased use, soon get rid of a very large amount, say four-fifths, of the smoke that arose from the domestic chimneys. They would also provide a source of profit to the Local Authority from those who liked to have their open fire, and have the privilege of poking it. That to some extent was one of the reasons for the continuance of smoke. It would be more beneficial and less costly to the owners of poor property to have smoke-consuming fireplaces, or that cooking should be carried on by gas. They would then have a very large amount of that smoke removed from the atmosphere without any of those various changes which had been suggested—that of laying on very heavy penalties against the offenders and preventing people having a fire to look at if they liked. He thought the plan he had suggested

would be found in the end to abolish the smoke nuisance more effectually than any others they could think of.

Mr. COLES said the main consideration was to avoid the production of smoke, and he contended that while it was possible under certain conditions to consume the first products of distillation arising from a fire after fresh coaling, it was not practicable in a broad sense to consume smoke. It should be prevented.

The PRESIDENT, in conveying a vote of thanks to Mr. Coles for his paper, said that that gentleman had, in conjunction with Dr. Lyon Playfair, been instrumental in forming the Smoke Abatement Association. It was of considerable importance that such institutions should exist in the country, because by making experiments they kept the matter continually before us. Even Royal Commissions confined themselves to acquiring information which existed among the people, and then giving it out in reports. What they desired most in nearly all the branches of sanitary inquiry was a proper series of experiments, and such, he believed, were carried out for small fire-places by the Smoke Abatement Association. Larger experiments, which were very expensive, could, perhaps, only be made by those who had large works, and were able to spend a considerable amount of money upon them. He alluded to the new methods of using coal, for example, the Simon-Carvés and Jameson furnaces. He also wished to call attention to the latest development of the Jameson furnace, which he found in action near Glasgow, although, so far as he knew, it was not in use anywhere else in the kingdom. He happened to go out on the Great Western Road this week, and there he saw a considerable number of large heaps of waste coal, and he was told that in one of these a method was being employed to make use of the smoke. He found that tubes had been inserted to a considerable depth into the mass, and a fan was drawing out the air and gases from the centre, and from under the surface of these heaps—the air going in by the surface, the smoke and some air of course being drawn out through the tubes. This smoke so carried off was converted into a constant flow of liquid, which contained ammonia and oil. The smoke had ceased from that part of the heap where these tubes were inserted, so that this process of Jameson's had made it possible to burn these enormous heaps, whose destruction was very important, and without being in any way offensive to the neighbours, and that, he believed, if not at a loss, at least without very great expense. Then there were different kinds of smoke—black and grey smoke—and as the colour was different the composition was different. In house fires the combustion was not sufficiently strong, the oleaginous matters were not sufficiently heated, and a greyish smoke appeared; with more heat smoke of a black colour was produced. Any method which increased the heat of combustion still more, and with sufficient air, would enable them to get rid of this black smoke. Mr. Muir's statement was that smoke could be consumed by proper apparatus, but Dr. Smith was looking forward to an improved use of coal, which would not depend on those mechanical agencies which Mr. Muir

alluded to. He found that in most towns those who were entrusted with the duty of putting down smoke were smoke consumers themselves, and it was, therefore, difficult to get these Acts put into operation. He looked more, however, to invention and to the spread of knowledge amongst the people than to legislation for improvement in this matter.

On "The Treatment and Utilization of Town Refuse," by JOHN COLLINS, F.C.S., F.G.S., &c.

THE writer has little apology to offer in submitting this paper to the Congress of the Sanitary Institute save that of its importance and the little scientific attention which has been paid to the subject of it hitherto.

There can be no doubt that the disposal and utilization of effete and offensive town matters, as derived from middens, cesspools, &c., forms one of the most difficult as one of the most important problems with which we have at present to deal. For, while the modes of treatment and of disposal may not be too technical or too expensive, the work must be thoroughly done, and in such way, too, as to cause no nuisance or damage.

In large manufacturing towns, where action is most needed, the problem is necessarily most difficult.

It is not proposed by the writer to deal, in any way with sewage, properly so called, but with such towns' refuse as is commonly found in the endless variety of substances in cesspools, midden heaps, excretal refuse, market, and other garbage.

The depôt, or works, for dealing with these should be as central as may be, and must have the necessary aids to cheap and rapid transport offered by rail or canal, or both. The arrangement of plant, &c., must be simple and not liable easily to get out of order or to suffer from indifference or mismanagement. The process of utilization must also be rapid, in the disposal of what are really offensively disgusting, and, in many cases, dangerous matters. The means of transport must provide an outlet into an agricultural district which shall be handy for application and consumption at low rates.

Without going into the means adopted to secure these ends in other places, the town in which the writer practices affords, as he believes, an illustration—as advanced as may be found—of a mode of cheap and thorough disposal of efféte town refuse; and it is the main purpose of this paper to lay before the Congress the means whereby this is effected and to what extent.

The population of Bolton is about 106,000. The midden and

open cesspool prevails, although there are a few water closets, and a considerable part of the newer cottage property is provided with "pails."

The collection and scavenging of these is mainly effected in the night, and by means of *closed* carts of excellent design. These matters are roughly assorted on loading. Dry ashes from fires and furnaces only are taken and "tipped" outside the town. All other matters are carted to the works, and are again sorted on their arrival. When needed they are deodorized. They are all immediately dealt with, and no accumulation is permitted. The drains and sewers therein are all disconnected with the town system, and their contents are dealt with in the works.

The material brought to the yard works may be described generally as domestic and market refuse and street sweepings. It contains cinders, coal, ashes, brickbats, glass, crockery, mortar, old carpets and shoes, paper, rags, bones, cabbage stalks and other vegetable refuse, sound and unsound, entrails of birds and fish, manure and fæcal matters, oyster shells, dead kittens, old meat tins and pails, bottles and jars in earthenware and in glass, old iron, &c., &c.

On arrival, this is variously dealt with. The comparatively dry ashpit refuse is assorted, and part is ground with fæcal and other effete matters into a manure of a dark grey colour, inodorous and pulverulent, and having little about it to suggest its origin. This manure is at once sold to the farmers, or it is stacked in the staiths specially provided for it, until the season arrives when it is required.

No nuisance, nor even smell, is due to, or is caused by this stacking.

Another part is charged to the "Destructors" (Fry's), where it is burnt, leaving only a residuum of "clinker" and of ash, which is, in its turn, used for making a capital mortar and cement, and for road making.

In this way the whole of the "refuse" is daily dealt with immediately on its arrival, and it is in no case permitted to remain to become the nuisance and danger to health it would otherwise surely become.

Were the burning carried on in open heaps, or in openly constructed furnaces, it would pobably be found to constitute a very serious and dangerous nuisance. But, here, the furnace is specially designed, and no such result can arise.

It is self-sealing, and is connected with a chimney shaft 180 feet high, with a mean sectional area of 49 square feet, and a mean draft of 107,800 cubic feet per minute.

Traces of the gases passing away by this chimney have been sought for in the atmosphere as a pollution, through an area

having a radius of 2,600 yards as the crow flies. The tables appended will show how far this was successful. The quantity of "smoke" is very small, and has the faintest diagreeable odour. It is mainly watery vapour.

A fine dust (Table 3) is one of the results of this "destruction." It is lightish grey, caustic, and absorbent. It is inodorous, and not in any way more offensive than is ordinary flue dust.

The "clinker" and ash (Table 3) is absolutely inodorous and inoffensive.

The samples of air (Tables 1 and 3) were taken under the following conditions:—

No. 1.	Wind	S.W.	...	Temp.	65° F....	Showery.
2.	„	„	...	„	68° „ ...	„
3.	„	„	...	„	68° „ ...	„
3*a*.	„	W.	...	„	76° „ ...	Fine.
4.	„	„	...	„	70° „ ...	„
4*a*.	„	„	...	„	70° „ ...	„
4*b*.	„	„	...	„	68° „ ...	Heavy showers
4*c*.	„	W. & S.W.	...	„	70° „ ...	„
4*d*.	„	W.	...	„	78° „ ...	Fine.
5.	„	S.E. & E.	...	„	76° „ ...	„
6.	„	„	...	„	76° „ ...	„
7.	„	„	...	„	76° „ ...	„
7*a*.	„	S.W. & S.	....	„	70° „ ...	Showers.
7*b*.	„	„	...	„	70° „ ...	„
7*c*.	„	W. & S.W.	....	„	72° „ ...	Heavy showers.
7*d*.	„	„	...	„	72° „ ...	„
7*e*.	„	„	...	„	72° „ ...	„

It should be suggested here that the yard and works are immediately to the W. and S.W. of the town and adjacent thereto.

1. Heaton Cemetery lies to the W. of the town and outside it.
2. Junction of St. George's Road and Bridge Street lies N.E. and E.
3. Wellington Street lies immediately to the S.
4. Wellington Yard is the depôt and works.
5. Gas Street lies to the E., and contains Corporation Gas Works.
6. Back Milton Street lies immediately to S.W.
7. Black Horse Street lies E.

And the air analyses show this order as affected by polluting gases.

There is necessarily an occasional smell of fæcal matters in the works, but this is not more than would and does occur in the daily use of, and in the occasional emptying of the old privy provided in the back yard of each cottage, and it cannot be said to constitute an injurious nuisance.

The albumenoid ammonia supplies a measure of the nitrogenous organic bodies and putrescible matters, or of the sewage contamination of the atmosphere. It is always an ingredient in bad air, and it is rarely, if ever, absent in the air of all town dwellings. It is not there in sufficient quantity [see tables], to be noxious and injurious.

When manufactured and stacked, the manure has been carefully watched, to ascertain if any "heating" from storage or further decomposition occurred. But the stock is almost inodorous, and is certainly not offensive, for it cannot be detected at a distance of twenty yards. It will be seen that, after intimately dividing and mixing the ingredients, decomposition is stayed, and the gases are fixed, to be liberated only by the growing plant when applied in agriculture. The ammonia and other nitrogenous matters are intimately combined and admixed with carbon and other finely-ground absorbents, and hence no offensively-smelling gases are evolved. A sample of this manure has been in the writer's laboratory open and under ordinary conditions for over twelve months, and is now free from smell.

The temperature of the stock is very steady, at about 60°—61° F. Hence no decomposition is going on in the mass. for this would produce heating [Table 4].

The moisture in the ashpit refuse is usually about 10 per cent., and the whole of this water is vaporized in the "Destructor."

It is not within the province of the present writer to give the costs of this mode of disposing of town refuse; but it will be seen that it must be economical, as it is effectual. No attempt is made to "manufacture" a high class "guano" or other manure. The first object aimed at is the getting rid of an evil. The next, how to do this cheaply and effectually. It is believed this is done in the case here described: for the ordinary means for collection and removal are sufficient and ample. The plant for dealing with the matters is simple and economical, and the results are merchantable and find ready sale. Much is disposed of as made, and of the remainder the stock disappears in a few days when the season for its application arrives. It does not pay expenses, of course, but it costs less, it is believed, than any other plan in operation on a similar scale.

The superintendence and laying out of the works and plant, and the general success of the process adopted, owes much to the close attention and the indefatigable oversight of his worship the Mayor of Bolton, E. G. Harwood, Esq., and only in a less degree to the committee over which he presided, and which had charge of this department.

TABLE 1.—AIR ANALYSES.

TABLE 2.—ANALYSIS OF CHIMNEY GASES.

Table 3.

A.—*Analysis of the grey or whitish flue or vapour deposit from Chimney Gases—*

	Per cent.
Loss on ignition at white heat	14·06
Lime Sulphate	15·09
Potash „	19·30
Soda „	2·64
Sodium Chloride	1·96
Ignited residuum: insoluble in water	46·95
	100·00

B.—*Analysis of Ash and Clinker (average) from "destructor"—*

	Per cent.
Silicate of Alumina	38·46
Lime	4·01
Magnesia	0·63
Iron	11·02
Carbon	30·16
Salts of Sodium and Potassium	1·51
Insoluable matter and loss	14·21
	100·00

TABLE 4.—AIR ANALYSES.

	Oxygen.	Carbonic Acid.	Ammonia, parts per Mill.		Index No.
			Free.	Albumenised.	
	Per cent.	Per cent.			
9th Aug., 1882, 10.35 a.m. In Wellington Yard	20·94	0·035	0·046	0·075	25
„ 10.42 a.m. In Wellington Street..	20·91	0·038	0·046	0·070	26
„ 10.48 a.m. In Back Wellington Street	20·86	0·041	0·058	0·081	27
„ 11.5 a.m. In Back Milton Street	20·89	0·040	0·063	0·086	28
„ 11.18 a.m.	20·91	0·039	0·051	0·073	29

TABLE 4*a*.

Observations and Experiments on Temperature of Air and of Stock Manure—

	Temp. of air in shade.	Temp. manure at depth of 12ft.	In stock averages at depth of 7ft. 6ins.
11th August, 1882, 11.30 a.m.	72°·0 F.	61°·0 F.	63°·0 F.
14th „ „ 11.10 a.m.	75°·0 F.	61°·0 F.	63°·0 F.

The average temperature manure is 11° F. *below* that of atmosphere as shown above.

"FELICITY AS A SANITARY RESEARCH."

LECTURE TO THE CONGRESS.

By Benjamin Ward Richardson, M.D., F.R.S.

Our Congress this year has been ringing peals of congratulations, and the peals are deserved. Sanitary science, in some simple directions, has won triumphs such as have never been won before, and its advocates, once called enthusiasts, dreamers, visionaries, and other poetical names, are now, in respect to enthusiasms, dreams, visions, looked upon as common-place observers. The miracles they declared posssible are performed so regularly that wonder and doubt have ceased.

We sanitarians declared that it would be a comparatively easy task to find out the courses and, at least, the proximate causes of the great pestilences, and that, with a fair knowledge on these subjects, combined with a comparative ready assistance by the public, we could control both the courses and the causes. The work has not been done so thoroughly as we could have wished, because the public has not come up, as yet, to our views; but the work is progressing, and sufficient is already done to prove the truth of our position.

We said that the once current rates of mortality were deathly of deathly; that they represented a low civilization; that they might, in these countries, be reduced generally to a mean of fifteen in the thousand per annum, and, in favoured localities, to a lower figure still. We were taunted with the rejoinder, that if such were accomplished men and women would live a hundred and fifty years. We replied, Let them live two hundred years if they like, but let us, any way, reduce the huge mortalities which are considered natural.

The result of our work is that there are towns where the average mortality is actually lower than fifteen in the thousand. Strangely too the popular cry is not now against us as enthusiasts but against towns which do not follow up our enthusiasm. Towns, therefore, in this day, compete with towns for a low

death rate, knowing well that should mortality, from temporary and as yet accidental causes, rise to what was considered the mere natural a quarter of a century ago, they are temporarily ruined if they depend upon outside popular favour for existence.

All this is most satisfactory and would afford a fruitful theme of discourse. But what I want to-night to rivet on the memory is a new thought for new work. I want to put a question or two and endeavour to answer them.

Can we honestly believe that these triumphs of ours, which have so far ended in a certain victory over death, have introduced any fraction of triumph over misery?

Have we by our labours assisted to make men, women, and children happier as well as longer lived?

Have we tried to effect anything in that way, or have we, aiming at nothing more than the promotion of a longer life, left the rest to chance as if it were not our duty to include human Felicity in our design of labour?

Can we effect anything to ensure Felicity as well as length of days? In other words, is Felicity a subject open to sanitary research, and if so, in what directions shall we labour for it?

These questions are momentous, because, if we are aiding in the art of adding to length of life and in developing populations, without giving to an extended and universal life, Felicity, or the enjoyment of that which is given, we may, in the long run, be working evil rather than good for the human race.

A race unhappy lives too long to live.

Surveying the questions I have submitted, I do not think that we have so far done anything to add to human felicity. In the first stages of our labours that, indeed, were impossible. We have had to deal with very unpopular and, some think, unsavoury subjects. We have had to be excessively personal. We have been obliged to tell people to be clean both at home and abroad. We have been forced to be fault-finders all round. We have even had to frighten the masses, and fear is a terrible foe to felicity, both in the house and out of it; and until, one day, I ventured to show, by an allegory, a pleasant side-station on our steep and narrow road, we seemed to conceal the destinies we had in view, or to leave them for anybody to discover—an almost hopeless leaving.

We have not tried, therefore, in any direct manner to teach the way to felicity. We may, like the rest of the world, have spoken of health and happiness. We may have commented on the sound mind in the sound body; but we have not tried to systematize effort towards the attainment of felicity as we have towards the attainment of length of days.

I may make these admissions without the slightest compunc-

tion or regret. If we have done no good in the direction I have referred to we have certainly done no wrong. There has not been sufficient time for a development of Infelicity from extension of life, so we need not ourselves be unhappy.

But now comes the last question.

Can we by any future effort advance human Felicity by a scientific research into the sources of it, and the impediments to it? Can we, scientifically, connect health with happiness? If we cannot we had better never have been born. We are like preachers of mercy who are empty of charity. We are mere sounding brass and tinkling cymbal.

I do not for my part believe that we are in this plight. I hope it is all right that we were born. I believe that we have the moral as well as the physical health in plain subject before us for study, and that we of all men ought to see how to combine the physical with the moral, and to understand the relationships of the one to the other and the interdependence of the one on the other. I trust, therefore, that from this present Glasgow Congress we may take a new departure by inaugurating a new school of sanitary students and scholars, whose interests it shall be to learn the physical and moral art of living well, so that bodily health shall, of a truth, be mental felicity. A dream do I hear it said! If I do, I hesitate not. It was a dream a quarter of a century ago that men could touch death rates and reduce them to order. To-day the dream is a fact.

I see no reason why we should not, by patient research, know all that pertains to our own lower natures at least. I can feel the astronomer overwhelmed with the sublime story that lies before him. I can see the metaphysical philosopher overwhelmed as he questions the illimitable destinies and the sources of illimitable power and will and being. But we sanitarians dealing with secondary phenomena, with phenomena repeating at every moment, with our timepiece selves going through regular courses of eating, drinking, breathing, thinking, working, wearing, sleeping; with mechanism that can be counted, measured, weighed, and calculated on commercial values; we surely have no insurmountable difficulties to get over in determining what are the conditions under which human felicity is possible, and what are the conditions which prevent the accomplishment of felicity. The hardness of the task lies, at the outset, in getting a good view of the actual meaning of Felicity.

Felicity is contrast to misery. To many minds no more. A fancy, an invisible breath of some poet who writes what he has never known, and has never expected to know; or a laugh of some cynic who, tired of life and its vanities, declares that

'All things are alike to all,' and that man, with the beasts, neither goes upwards nor downwards, but dies.

To men who, like myself, are engaged for ten to eleven months each year listening to the sorrows which the sick are forced to tell and the healthy are forced to confirm, it would not be difficult to conclude that there is in the human world no such thing as felicity. There was a noted physician I once knew well, who told me at the close of a career of fifty years of active practice, during which few men had seen more of his fellow men or had observed more keenly, that he never had met a perfectly, or, indeed, a comparatively happy human being. His view was not altogether peculiar. The professors of medicine, generally, are felt by many to be stoically indifferent to sorrow as compared with other persons. They are not so at heart, but, knowing the smallness of human felicity, they are less oppressed than others by the extreme and tenderly acute occurrences of sorrow. They read the Book of Wisdom every day from nature, as the Chaldaic writer of it did, and so, in the everlasting presence of nature, become possessed of a demeanour which seems to separate them from the individual life; and as in that presence felicity is not the feature they are most wont to recognise, they give it wings to fly.

Proofs of Felicity.

By the hard and fast scientific mode of looking at the phenomena of Nature, it might seem, then, at first view, that human felicity had no proofs of existence. There are, fortunately, other evidences which give positive proofs in characters as purely scientific as any in the observation of science. Granting that these are exceptional evidences, they are still in proof.

I notice four of these evidences as all sufficient.

1. In perfect childhood, uncrossed by perverse and chilling influences, and blessed by health, felicity exists, not, perchance, universally, but as a rule. I remember some few pages of my own childhood which were filled with an unbounded felicity—a felicity to be remembered, although it cannot be again realized or explained in relation to the precise causes that led to it. I have questioned others on the same point, and although the response was much more frequently in the negative than I expected to find it, and although the inquiry has often laid bare a recollection of misery rather than of felicity, that could not have been anticipated in childhood, it has yielded, certainly, a majority on the affirmative side. The evidence is sufficient to prove the reality of the phenomenon in at least one stage of life.

2. There are, again, men and women who, by some fortunate heredity of constitution, go through long, trying, and eventful careers with perfection of felicity. Dr. Joseph Priestley was one of these fortunates. "I was born," he says, "of a happy disposition." And so this man, through a life of struggle and tempest such as few men have known, was ever in felicity. In his child life he loses his mother. He leaves his home, and is domiciled with an aunt, whose gloomy tenets would drive some natures to the deepest melancholy. He passes through severe changes of thought on solemnest subjects. He becomes a preacher, but, owing to a defect of speech, cannot display an eloquence he knows is in him, and, tossed from pulpit to pulpit, penniless, is forced to teach that he may live. He becomes half friend, half librarian, of a nobleman, by whom he is petted at first, and then, with the capriciousness of power, is turned off, as a once favoured dog might be, without a word of explanation. He makes one of the grandest discoveries of the century, and lives to see the discovery accredited to another man, to whom he communicated it in the most open manner. Suspected of sympathising with children of liberty he becomes, under the instigation of a rival preacher, the victim of a furious mob which burns his house, and all his precious papers and treasures, wishing him heartily the same fate. Escaping to London he is obliged to hide from enmity, and, cruelest cut of all, is disowned by and cast out of the learned society, whose work he has helped to immortalize. At last, driven in his old age, from his native country he goes, forgiving everyone, to a foreign and distant land to die there in perfect peace.

Such changes as these, such oppressions through every stage of life, would kill a multitude of ordinary men. Yet here was one who went through every phase of suffering with felicity. His friends, one and all, bear witness to this fact from their objective side. He personally testifies to the same, and explains the reason: "I was born of a happy disposition."

We gather from such instances as these, rare it is true, but reliable, that in the range of physical life there is a felicity due to heredity; to some combinations of ancestry, which, being repeated, would lead to the birth of an almost new race amongst which, Priestly's own maxim, "the greatest good for the greatest number," would be the common blessing. For, that which has once been born may be born again, and by birth become universal as a progress. If one man can hold felicity in his hand all his life and under all adversities, why not all men?

3. There is a third proof of felicity which comes within the knowledge of the majority of mankind although it is not

universal, for I have known a few who have afforded no evidence of it. This proof consists of the sensation felt, I repeat, by most persons of a sense of peace, tranquillity, and, in a word, felicity, which, in consequence of its abruptness and the sharp contrast between what has gone before, is a cause of extreme surprise. In such moments the actual cares of the world, cares heavy and sorrowful, sit lightly; the impossible, a short time before, becomes the possible or the easy. Dark forebodings which have pressed, almost to despair, pass away and the future is roseate with prospect.

There are few now present who have not experienced this curious change towards felicity. They may say that it is a fleeting change, and that may be true; but the fact is certain. It is also, immeasurably instructive, for, if felicity can be obtained for one day, for one hour, why not for all days, for all hours.

These flashes of felicity are, I have said, sometimes startling from their abruptness. They are at other times equally startling from their intensity, and from the relief they give to the opposite depression, from which they stand out in contrast.

In speaking of this contrast, and of the advent of felicity after extreme depression, the common terms used to express the conditions are singular. The depression is almost invariably described as a physical weight, and felicity as the removal of a weight, which, like a physical burthen, has oppressed the body, and, in extreme instances, has bent it low. "He is bowed down with sorrow" is an expression as true as it is striking. Bunyan seizes on this physical truth. His pilgrim, while yet wanting felicity, is troubled with a burthen which weighs upon his back night and day, felicity coming when that burthen falls from his shoulders. The illusionist has here defined what he himself had felt, and hence the force of a description which every man and woman who has read Bunyan has, with very few exceptions, recognised. Felicity is lightness from burthen. The common folk call it lightness of spirit, light-heartedness, as being lifted up above the common fate of daily oppression and daily sorrow. The terms define the state.

When felicity is most absent, the sense of depression shows itself in other ways which indicate the physical process, and suggest the ponderable nature of something that tells on the body and on the mind. In worst states of depression the faculty of memory is often overburthened with labour of details, long stored up, which are remembered, re-arranged, and re-conjectured upon with painful and accurate precision. The thoughts undulate, and great waves seem to overwhelm another organisation belonging to the man himself, yet lying afar back and obscured by these rolling tides, dark, dense, material, weighty.

With felicity all these waves of deathly pressure pass away. The memory is charged with no recurring scene of sadness. The calculated difficulties do not appear. The organisation which lies in the shade becomes brilliant, and the future hopeful.

These phenomena constitute both by reality and contrast what may be called the full grown subjective proofs of felicity.

4. Lastly, there are certain objective proofs which lookers on may observe if they will notice others, and which as independent evidences are perhaps the most reliable. A good perception of character and, if I may say, diagnosis, leads the looker on to note and know the symptoms of felicity in others, for the symptoms are clear. In the wake of felicity the pulses are regular, tonic, free. The breathing is natural. The eye is bright and clear. The countenance, even in age, is youthful. The appetites are keen but orderly. The judgment is sound and joyous. The muscular bearing is firm, co-ordinate, steady; there is no indication of carrying a load on the back, nor of oppressive sinking exhaustion.

In the above few passages I have sketched out, as far as I dare in the allotted time, the phenomena of the felicity we are now considering. I have entered into no metaphysical subtleties in definition, but have rested on every-day experience, and having thereby, I think, afforded evidence of the fact of felicity, I pass to the thought how to extend this state—a thought which, according to my view, is eminently sanitary and practical.

Physical Conditions influencing Felicity.

To arrive at the true mode of working for this object we cannot do better than survey, in the first place, the conditions under which the phenomena of felicity, and of its opposite depression, or infelicity, are manifested.

Atmospherical Conditions.

By a sort of general impression the weather is believed to exert a peculiar influence for and against the phenomena of felicity. In this view there is undoubted truth. An *increase of the atmospheric pressure and a decrease* is each a cause of felicity. In ascending from valleys to moderate heights there is, up to a certain distance, a distinct effect of the kind. So definite is this action that I know of one person who, under some conditions, feels life is a load too hard to bear, but who, in a dry, bright, mountain region to which resort is often had, throws off the despair altogether, and lives

a new life. In the nicely-adjusted balance of atmospheric pressure against animal circulation of blood, the circulation is relieved by a moderate removal of pressure. But if such removal be too great, if the organs of the body become congested from the removal, as they may be, the spell is broken.

The brightness of mind induced by removal of pressure and freer circulation is, however, bound by other conditions. Dryness must accompany lightness of air to produce the state favourable to felicity.

There may, again, be conditions in which a slight excess of pressure may be conducive to felicity. In regions where the land is low, compared with the sea level, a slight atmospheric pressure may be advantageous. The air is usually drier under pressure, the wind bracing, and the vital organs charged with blood, conditions essentially favourable in low lying districts to the communities that occupy them.

There are *electrical conditions* of the atmosphere during which felicity contrasts strongly and strangely with the depression incident to other conditions. My friend Mr. Hingeston, of Brighton, has very beautifully connected these varying states of atmosphere, from electrical influences, and these varying states of mind with cloudland. He reads in the clouds the outward and visible signs of the mental state. The large white-headed cumuli that collect in clear bright days are rotary storms of hail, rain, or thunder, gyrating from left to right. Several of these gyrating storms keep marching onwards in alternate spaces, marshalled in vast circular array, and rolling round a circumference of bright translucent calm.

On the approach of one of these masses of vapour the mercury of the barometer first falls, and then rises with great rapidity.

The accompanying and residual state of the atmosphere is congenial to health. Now the debilitated experience, favourable reaction, and the mind is serene and happy. The air in these moments is antagonistic to disease. With the breaking up and dissolving of these large cumuli there is electric action, and most likely explosion, as the vapour is condensed into water.

The entire atmosphere changes; everything is dull and grey; the so-called dyspepsia prevails, the acid indigestion of gouty habits, the scrofulous indolent and pitiable host of "never wells."

Thus, continues my friend, the sensorial effects of the electrical fluid are proof paramount of its pathological, physiological energy, and the various forms assumed by the vapours condensing or dissolving in the air,—clouds—may be considered not only as picturesque beauties in the landscape, but also as criteria for judging of some of the most potent effects resulting from

the operation of an experiment, silently and delicately performed upon the functions and sensations of animated beings.

Cold and Heat each play different parts in production and reduction of felicity. A dry and sharp cold, what is called a bracing cold, exerts a gentle pressure on the surface of the body, which fills the nervous centres with blood, and helps to felicity of mind. A long and piercing easterly chilling cold checks circulation, robs heat, and produces even melancholic sadness. A dry genial warmth acts like a bracing cold; a long warmth with moisture checks the vital action, and produces a degree of depression which may be as intense as that which is induced by prolonged exposure to cold.

The seasons of the year which are attended with least exhaustion of the body are those which favour felicity. When the exhaustion of the winter and depressing spring months has been removed by the warmth of a genial summer and autumn, the time is most favourable for serenity of mind. On the other hand, the exhaustion of winter and spring induces depression and is no doubt the cause of that melancholy which renders the months of April, May, and June the maximum periods of death by suicide.

Purity of the atmosphere is an unquestionable aid to felicity. The comparison of children living under differing circumstances is sufficient proof of this fact. Children in an open well-ventilated schoolroom, how different are they from those who are immured in the close over-packed dens which are mis-called schoolrooms. The felicity of the children of the well-to-do who live out of doors, and of the children of the fields and open streets, compared with the felicity of those of the small trader whose back parlour is living room and playground; the felicity of the man or woman who leads an out-door life, compared with the felicity of those who live in the close office or workroom, how entirely different.

Foods, Drinks, Narcotics.

There are still other agencies which bring or which check human felicity, and which are as purely physical in character as those above recorded.

There are substances which taken into the body produce strange contrasts in respect to felicity and depression. Foods well cooked, foods carefully selected, foods supplied in sufficient quantity to sustain the body equably in all its parts, but so moderately as never to oppress the nervous digestive powers, conduce to felicity in the most telling manner. As a rule all agents which stimulate, that is to say, relax the arterial tension

and so allow the blood a freer course through the organs, promote, for a time, felicity, but in the reaction leave depression. The alkaloid in tea, theine, has this effect. It causes a short and slight felicity. It causes, in a large number of persons, a long and severe and even painful sadness. There are many who never know a day of felicity owing to this one destroying cause. In our poorer districts, amongst the poor women of our industrial populations, our spinning, our stocking weaving women, the misery incident to their lot is often doubled by this one agent.

There is another agent more determinate in its effects and contrasts than tea, and that is wine. I am a total abstainer, but I am, I trust, an honest observer also, and I confirm, from direct observation the old saying, that "wine maketh glad the heart of man." If it did this and no more, I should say let the felicity of wine remain to the world. Wine, like the alkaloid in tea, relaxes, lets loose the channels of the blood; gladdens like the ascent of the mountain side; gladdens like the gentle atmospheric pressure which forces more blood on to the internal parts. But, and here alas! is the rub. Carried a little beyond the right mark, the felicity from wine passes into folly, the folly into feebleness, the feebleness into stupor, and the stupor into a depression the reaction from which is the bitterest, the most persistent.

Tobacco is another substance used to produce abeyance of anxiety. Tobacco is said to soothe irritability without stimulation, but it leaves, in many persons, long depression coupled, generally, with an appetite for a renewed indulgence in it, which becomes intense. The confirmed smoker, who can stand out against indirect effects, whose taste for food and whose digestive endurance are little injured, is kept during the whole time he indulges, in the state of suspension. He does not enjoy felicity, but for the time experiences a relief from infelicity. My own experience, on the whole, is opposed to the indulgence, and I tasted it for a long period of my life, as well as observed the effect of it on others. To the aged it gives, I confess, a negative existence, which when the mind is not filled with choice or refined or cultivated pleasures makes time less wearisome. To the man who engages in work of great excitement and of a mental kind it brings a joyless repose. But, on the whole, it is a bad and sometimes a fatally bad indulgence. I have once known a man die directly from the effects, and how many I have seen injured I cannot say, but a large number. Again I have seen many much depressed by it; so that I dare not put it forward, at its best, as a promoter of felicity. The world, I must conclude, would be happier if tobacco were unknown or unemployed.

The habitual use of opium for the obtainment of felicity is of the same erroneous character. The opium smoker, the opium eater, tell us of certain dreams and phantasies which are, for a moment, felicitous wanderings of the mind. I have visited the opium dens to see the effects, and whatever the dream may be, subjectively, it presents to the observer no sign of felicity. The expression of the opium smoker is one of restless and intense anxiety. He looks like a man in a dream of misery. His eyes are joyless, his features contorted, his skin colourless or dark, his pulse slow and labouring, his breathing hard and heavy; and, when from the half struggling consciousness he wakes to reason, the dream he describes is too confused to be accepted as a dream of felicity. Then he falls into dejection which deepens and deepens until the desire to return to the cause of the dejection is too overpowering to be resisted. To opium eating and to the subcutaneous injection of morphia the same description, with some modifications on which I need not dwell, is perfectly applicable. From the use of such an agent as opium there can be no result of human felicity. There could soon be produced by an extension of the use a madder world than now exists, a more miserable; a happier, never!

And this saying, according to my knowledge, extends to all narcotic substances. There are some, like methylic ether and nitrous oxide gas, which produce for the moment infinitely more refined felicity than those I have specifically named, but in the end the results are the same.

Constitutional Influences.

I have dwelt thus far on influences of a purely physical kind in their relation to felicity. I have put these influences in contrast as affecting the state of felicity, and I have touched on some agencies which are used to produce a mock felicity. I must move from these to a brief consideration of other influences of a different nature which affect us for or against our happy or felicitous existence.

Temperaments and Heredities.

There are some constitutional differences, determined by temperaments, which are of first importance. Of the four primary temperaments, the sanguine, the nervous, the bilious, the lymphatic, and of their relation to felicity, a volume might be written, and I have collected the facts relating to the temperaments of over a thousand persons, towards such a work. I must not here touch, however, on any detail. I must be content to record, as a general fact, that the sanguine is, altogether, the happier temperament, but not always the most sustained as

such; that the dark or bilious is the least happy in early life, but is often, in later life, more serene; that the nervous is a varying condition full of ups and downs; that the lymphatic is, by a negative effect, the most even; that, amongst the twenty-four combinations of temperaments the sanguine lymphatic is the most felicitous in respect to physical pleasures; and the bilious sanguine and the bilious lymphatic in respect to intellectual; that the nervous sanguine is the most irritable; and the nervous lymphatic the most helpless and miserable.

The moral influences and impressions affecting these natures are, from first to last, potent for good or for evil. In childhood the future history of the felicitous or infelicitous after-life is usually written. A few, born, like Dr. Priestly, of a happy disposition, fight through all adversity, filled with a magic soul of felicity, but they are very few and are commonly, though I dare not, in the face of natural truth, say, always good. They, even in childhood, are not affected as others are. In the schoolroom as in the playground they are comparatively happy.

As a rule, the tendency to felicity or its opposite is planted in childhood. The parent, the schoolmaster, the schoolmistress hold the book not of learning simply but of fate. To the imitative mind of the young, absorbing all that the senses can carry to it and the nervous centres can retain, the character of the presiding mind, ever present with joy or sorrow, justice or injustice, love or hate, cruelty or mercy as its qualities, is the beginning of the end.

Let me, as bearing on these matters of thought, not diverge from, but converge to, our present study, by a reference to the position of felicity as a physiological quality in life.

Of the two living natures with which man is endowed, and which distinguish him from the lower creation,—the pure animal and the pure intellectual natures,—felicity belongs to the animal nature. An intellectuality that would separate man from the animal would leave him beyond either felicity or infelicity.

Felicity, in fact, is not an intellectual quality, it is not centred in the brain. It is not a quality which a man can think himself into, or reason himself into, or directly will himself into. It is like the beating of his heart and the circulation of his blood, a vital process going on independently of his volition. He can by rude process destroy it for himself as he can for others. He can kill it for himself as he can stop the motion of his blood by stabbing himself to the heart, but still the quality is so independent of himself that he is often forced to be in felicity by things and acts and circumstances which his reason scorns. "Why does this fool of a book make me happy," said

a hard and suffering and miserable patient once to me as he pitched his "Pickwick" to the foot of the bed. "Yet it is the only thing that does, while all the time I know that such a set of asses as these Pickwickians could never, possibly, have existed."

By experience of what seems to increase felicity to lighten misery, to make misery, we often confound felicity and sorrow with intellect. This is merely our own external looking upon external manifestations of internal phenomena which we know we cannot influence in the same way as we can teach a lesson or convey a fact, but which we strive to control because we think we must do something, even for the uncontrollable.

Felicity and Infelicity are not intellectual faculties, neither are they passions, neither have they any direct relationship to physical pain. They are distinct from intellect, passion, physical pain. They are the only true emotions. The man who is destitute altogether of felicity is not, of necessity, intellectual, passionate, destitute of passion, or more or less sensitive to pain than anyone else. The most intellectual may be the most miserable; the most silly and inconsequent may be the most blest with felicity. The worst instance of extreme, I may truly say harrowing misery, I ever knew was in one whose clearness and calmness of judgment was a subject of general admiration, but who had never, he told me, known in all his life an hour of felicity. The man most replete with felicity I ever knew was one endowed with no intellectual supremacy at all, and who was all through a long life a veritable child.

The centre of the emotion of felicity is not in the brain. The centre is in the vital nervous system, in the great ganglia of the sympathetic, lying not in the cerebro-spinal cavities, but in the cavities of the body itself, near the stomach and on the heart. We know where the glow which indicates felicity is felt; our poets have ever described it with perfect truthfulness as in the breast. It comes as a fire kindling there: no living being ever felt happy in the head: everybody who has felt felicity has felt it as from within the body. We know, again, where the depression of misery is located; our physicians of all time have defined that, and have named the disease of misery from its local seat. The man who is always miserable is a "hypochondriac;" his affection is seated under the lower ribs. No man ever felt misery in the head. Every man who has felt misery knows that it springs from the body, speaks of it as an exhaustion, a sinking there. He is broken-hearted; he is failing at the centre of life; he is bent down because of the central failure, and his own shoulders, too heavy to be borne, feel as if oppressed by an added weight or burthen, under which he bends as though all the cares of the world were upon him to bear him down.

Habitual, Sensational and Moral Influences.

There are numerous influences which, in an indirect way, tell upon felicity, for it or against it, as distinctly as those grosser agencies of which I spoke in the earlier part of this section of my lecture. To these I would now invite attention.

The influences to which I am about to refer are, in reality, purely physical in their action, although they are commonly known as habitual, sensational, moral, or mental influences.

I notice, in the first place, that felicity is always favoured by sufficiency of *rest and sleep*. Bad sleepers know no felicity; but they who in childhood and old age sleep ten hours, in adolesence nine, and in full age eight hours, out of the twenty-four, and that soundly, are mostly well favoured with felicity. They may be exposed to causes which are opposed to felicity, but even then the causes are feebler in action than they otherwise would be. I put sleep in the first place as an aid to felicity because it comes first. I have no knowledge of any instance in which a person who slept well was altogether devoid of felicity. The beneficent action of sleep is, however, indirect. It is due to the physical and mental strength which it confers on its favoured child.

Strength of body secures felicity. Persons comparatively weak of mind may, with a good physique, be happy; but very few who are weak of body have any long tastes of felicity. We may take it all round that the feeble of all ages are unhappy. It is a matter of common observation that persons who are so unfortunate as to be born deformed of body, though the defect be concealed or hidden, are not blessed with felicity. It need not be the deformity that causes the infelicity, for the deformity may be concealed; the bad health is the rooted cause. Let the defect be from accident happening to a body born of good stamina, and felicity may be the same as in others, despite the acquired defect.

Any sign of inherited weakness is an equal sign of lessened felicity, though it be marked by no physical defect. It has been long observed by physicians that persons who from early life show very large and prominent veins and thereby a languid circulation of the blood are never happy, while those of well-knit body are. The observation is true as steel. We physicians know that a sluggish circulation is incompatible with felicity, and that they who show this indication, by such local diseases as hæmorrhoids for example, are amongst the most depressed of those who consult us. We say of them that they suffer from arrested circulation through the liver, and, doubtless, such arrest is depressing; but the arrest means physical exhaustion,

and physical exhaustion is the root of the evil. When the circulation is sluggish the liver is sluggish, and the brain is sluggish and the nervous centres are depressed. In a sentence, whatever prevents physical exhaustion and sustains physical strength sustains felicity, whatever exhausts sustains infelicity.

When the sun of life is high
  All is bright.
When the sun of life is low
  All is night.
Thus we laugh and thus we sigh,
Light and shade where'er we go.

Physical work, when it is carried short of exhaustion, keeps up felicity, and sloth destroys it. But the physical work that exhausts kills felicity. The argument extends to *mental work*. Moderate, wholesome, mental work is the best of all aids to felicity next to sleep; it strengthens the mind, it softens grief, it lessens care. Carried to excess it is pernicious and destroys all felicity. Cowper, the poet, was wont to say that no labour is so wearing as composition, and few men possibly felt more unhappiness as the result of mental exhaustion than he. But his was the fate of all who force the brain to daily or nightly repeated weariness.

The influences derivable from sleep and bodily power are purely physical influences, but there are others called *sensational*, which, through the physical power, have a potent effect for or against felicity. The sense of hearing has the most intimate connection with the vital or animal nervous system. The auditory nerve, as Dr. Bucke has shown, possesses many of the characteristics of an organic or sympathetic nerve, and we all know how many external vibrations which reach the ear, affect the digestive system, producing sense of warmth in the body, appetite for food and feeling of felicity; or, on the other hand, setting the teeth on edge, destroying appetite, and giving rise to gloom. Thus things told affect quickly, often permanently, for good or bad. The sense of sight influences also, but less intensely, and after a different manner. Sights gladden or dazzle, or pall, or sicken.

Not to extend an argument, which admits of any extension, the senses as doors and windows through which influences vibrate into the animal organization, can scarcely be touched by external phenomena without conveying some influence that shall make or disturb, or prevent felicity. When they convey beauty in sound or picture: when they convey variety; when they convey cheefulness of act, and manner, and voice, and feeling; when they convey to the soul the idea or story of generosity, of

courage, of purity of life and character, of prosperity; then they convey felicity, which passing through the brain on its way, finds its seat in the vital centres on and near the heart.

With Felicity as a sanitary research for my theme, I have striven so far to indicate what may be called the physiological bearings of the subject. I have endeavoured to show that felicity is something that is of hereditary quality; that it is something made or not made by external agencies over which we have little control: that it is something made or not made by many agencies, which we have diretly under our control.

In these respects felicity stands precisely in the same position as health; in the widest sense it means health, is another word for health. Health is born, and is made and unmade by external agencies which as yet are out of human control. Health is made and unmade by numerous influences which are under human control. Felicity, similarly influenced, depends on the good working of the animal or organic systems of life.

I could enter here into one of the most absorbing questions relating to the connections which exist between the lower and the higher human faculties. I could indicate how the lower and higher nervous centres, charged during life with a subtle ethereal medium, communicate with each other and with the outer universe, and how, by the states of this refined intercommunicating bond or sphere, both health and felicity are moved by external pressures, by external vibrations, by external agents taken into the living organism, by products generated within the organism and diffused through its own atmosphere. But I leave this inviting subject for a more immediately practical application of the few minutes which remain for discourse, viz.:—

Practical Design for Future Work.

Over those atmospherical causes which have been noticed as influencing felicity, we can exercise as yet no direct action. At the same time, just as we can now divert the lightning from its fatal course, we can indirectly effect good. We can prevent, as far as our teaching is effective, the erection of human habitations in dank and humid places, below the sea level, or in dry and arid spots. We can protest, and if we are clear and reasonable in our demands we can successfully protest, against the construction of new towns on melancholic foundations, and can explain the choicest places for felicitous existence in so far as foundation is concerned.

A Report from such an Institution as ours, or from any learned

sanitarian, on this one subject, addressed to those children of enterprise who are colonizing the worlds that are to come, would affect, if it took root at all, all the generations of the men to come in those new regions, and to a large extent the felicity of the whole future human family. In Africa at this moment the seed of new life that is being sown will, largely, be seed of felicity or seed of sorrow, according to the selection of the sites on which the new and great centres of life are constructed.

Nay, in this direction man himself may divert the operations of nature herself. He may change her surfaces as he cuts down her forests, or plants new forests, or alters the courses of rivers, or makes new courses, or fills up valleys, or lowers or raises mountains, or connects or disconnects oceans. With the mastery of the surface of the planet in his power, man may, in fact, make what regions he pleases for good or for evil.

The Earth is the Freehold of Man.

If the natural air which man makes not and invented not may be to a large extent utilized for felicity, how much more easy is it for him to remove the unnatural which he himself makes, so that instant advantage of what is provided for good may be rendered serviceable?

Here our voices should be heard in a tone not to be mistaken. We shut up our young in closest rooms of close towns; we shut up our men and women by the millions in close shops and factories. Some one million of us in these islands who call ourourselves, with ignorant irony, the ruling classes, shut up some twenty-five millions of the people with their wives and children in walled up atmospheres, where atmospheric purity is unknown, where cold and heat oppress, where food is what can be got, where drink is what can supply a false facility for a certain sorrow, where marriages re-establish misery, where good sleep is impossible, where physical strength is so impaired that a perfect body is not to be found, where exhaustion from work is the daily cross, where things and objects of beauty are rare as angels' visits, where in the selfish race to barely live generosity is impossible, where in compressed homes purity of mind is a thing the purest can scarcely maintain, where variety is replaced by the dead monotony of unchanging sounds for the ear to hear and scenes for the eye to see, where fear dominates over courage, where hope has no chance, where prosperity is so little known that the worn-out life has no expectation this side of the grave, and where death is so busy that three die to one of the more favoured communities. We, one million, I repeat, shut up our twenty-five millions under these conditions, and wonder why those millions know nothing of felicity; why

they are peevish, reckless, melancholy, sometimes drunken, sometimes rebellious and ready to run after any leader who shall promise to lead them into a happier sphere, however little removed from that in which they are. Wonder! the wonder is how human nature can bear such a famine of felicity and live as if it only lived to die.

To give the boon Felicity to these masses, we, not as revolutionaries, but as laborious workers for them and the thing most wanted, have, I trust, come into existence not in vain.

It is better for this work that we should be as we are—men of science rather than men of politics. We are, then, in the first and true place. We are educating politics as well as men by what we teach, an education which, in the present dense state of political darkness, is the noblest work we can possibly execute, until those who rule understand common human nature.

In the direction of education the sanitarian teacher should, I think, begin to study this psychological side of humanity; what human nature can and cannot bear; how much pressure can safely be put on humanity without danger of explosion; how much felicity can be secured by removing that danger.

Beyond the task of inculcating what are the necessities calling for pure atmospheres within and without the body, we can, most appropriately, explain what agents taken into the body are for felicity. We can teach what temperance in all things effects in this direction. We can use our earnest will in declaring for abstinence, where nothing but abstinence is the safe line of conduct. We can denounce every indulgence that undermines and mocks and destroys the blessing. We can insist on cleanliness; cleanliness of body, cleanliness of mind. We can show how flowers and plants grow for health as well as beauty, and why, for both health and beauty they must join the home circle if felicity is to enter it.

These are all sanitary questions, and they all, as one, bear on felicity.

We may educate again in another direction. It has been shown that some exceptional men are born of a happy disposition; and it might have been shown, on the clearest evidence, that multitudes are born of an unhappy, nay, miserable disposition. We could easily by our researches describe what are the lines of heredity for the happy and for the unhappy dispositions. We could, with this discovery in our hand, with certainty of being listened to and attended to, impress on the people the truth that marriages ought neither to be matters of chance nor matters of mere monetary convenience, nor, indeed,

matters of mere insane, so-called, love; but that the marriage tie, extending its influence into the future, and being no bond and seal of diseased heredities, should be the bond and seal of a healthier and happier racial progress in every succeeding generation. Now that our women are, by good fortune as well as good policy, made legally masters of their own property, this sanitary question, involved in marriage, was never so likely to be one of scientific value as it is at this moment, and as it will be in coming days.

We can teach forcibly and faithfully on a different topic regarding which we have a large amount of information collected. We can adopt and urge with all our power our veteran Chadwick's advice to those who are wanting to instruct the young, that it is the perfection of prudence first to live, then to learn. We can insist that, inasmuch as felicity is impossible under mental strain, it is fatal work to press on the young mind the excessive labour which is now in all departments making cram, cram, cram, the footing for knowledge. We can also tell the adult man struggling for the bubble reputation that broken sleep, and disturbed brain, and wearied muscle, and labouring heart, can never exist with felicity: that *sanitas* and *vanitas*, separated by one letter only, are as the poles, apart from each other; and that, *sanitas sanitatis, omnia sanitas* will never be established until, *vanitas vanitatis, omnia vanitas*, is blotted out.

We can instil yet one other lesson, last but not the least, into those foolishest of the foolish of the world who think that riches and idleness and power are synonymous with felicity. We can tell these that we who have read the human heart, who have learned by closest observation of fact the lives of men, that no success, no wealth, no power, gained by torture of effort for it, ever brings felicity, and that the Horatian verse:—

> "He who would hold the golden mean
> And live contentedly, between
> The poor man and the great,
> Ne'er feels the wants that pinch the poor,
> Nor plagues that haunt the rich man's door,
> Embittering all his state."

is as true in these days as it was in the days of the philosopher who wrote it.

Felicity as a Sanitary Research.—With all respectful thought I leave it on your memories. You may perchance think of

the idea as an enthusiasm, a vision. Never mind, so long as you think of it. It will grow upon you as a study, and grow from you as a project if it once take root. It will strike you, in time, as the *summum bonum* of sanitary labour; a re-echo of the divine declaration, "On earth peace and goodwill towards men."

The CHAIRMAN: You will agree with me, I think, that I was right when I said that Dr. Richardson would throw light upon many dark corners, and that he would teach us, as he has taught us, many and varied things. We have learned, in the first place, that happiness is very closely allied to the stomach; of that, I think, there is no doubt. In short, I am sometimes in the habit of saying that the circle of life is small, that we live to eat and eat to live. But Dr. Richardson has told us the more important thing that felicity greatly consists in the making of others happy, that the highest and purest and most enduring of all felicity is that in which we promote happiness in others, and that we do this most effectually, most surely, most permanently, by promoting health in their bodies. Certainly health is the great essential to happiness. Where there is health there is commonly happiness, and where there is no health there is no happiness; and as we, especially we of the medical profession, pass along life we often see a person living surrounded with all luxuries—a beautiful house and beautiful surroundings—and not happy, because he is not well. Dr. Richardson has told us that happiness is hereditary. We learn that man is born to *sorrow* as the sparks fly upwards; but I think that statement might be reversed. I believe truly that man is born to *happiness* as the sparks fly upwards and that happiness is the prevailing element of human life. No one can walk through the streets of Glasgow—through the main streets, with men hurrying and bustling about, through the narrow alleys, where little shoeless children are playing about—without feeling that they are for the most part happy, that happiness, after all, is prevailing among them. And I think we are born to happiness from two great qualities in our nature. The first is our remarkable adaptivity. We adapt ourselves to almost any conditions and any circumstances of life. Even the things which seem at first to be most disagreeable and most repugnant to us, we at last take to and enjoy, and cannot think of parting from them. The little dull alley, the little close house, the little dull, miserable room, become the centres and sources of happiness to the individual who has for some time dwelt in them; and, secondly, we are so constituted that the disagreeable and painful events of life leave less abiding impressions than those which are agreeable and joyous; so that the balance derived from memory is, in this respect, in our favour. Thus, I think we may take a broader view of human life than we are in the habit of doing, and that we may look upon our fellow men with the satisfaction of feeling that after all they are happy. Dr. Richardson has rubbed many of us the

wrong way. He has told us of the evils of alcohol, of the evils of tobacco, and of the evils of tea, and he has told us of the evils of love. I am bound to say that I think that without tea, without tobacco, without alcohol, and without love we should have but a dull life of it. I doubt very much, on the whole, if felicity would be greatly increased by the loss of all these, if indeed it would be by the loss of any of them. I wonder whether Dr. Richardson has lived without them all. I suspect that such a jolly-looking man as he, has had a certain share of them all. At any rate we wish him a long life and felicity, and I move a vote of thanks to him for his eloquent and varied and instructive lecture.

The LORD PROVOST: In the Town Council of Glasgow when any motion is made and is not opposed it is held not to require a seconder. I do not think that this motion which the chairman in such eloquent terms has proposed is likely to be opposed. Still as it has been your practice to have the motion seconded, I have the greatest pleasure in doing so. I think we may take some profit from Dr. Richardson's lecture, notwithstanding some inaccuracies which the chairman has discovered. It appeared to me as the doctor proceeded, that the practical issue of the whole might be that this Sanitary Institute might be asked to point to those situations on the earth's surface which we considered most suitable for our future towns to be built on. But it occurs to me that we might with advantage be asked to go a little farther than that, and advise how the towns should be built. I have seen, from this evening's newspapers, that a new doctrine to sanitarians has from this platform been enunciated to-day. We have been told that aggregating our population is not to increase our death-rate. My reading and experience is altogether contrary to that. I have found that in those districts of our great towns where the population was closely packed together, we had invariably a high death-rate. Indeed I cannot conceive that when the breathing space which each man needs, is curtailed by placing half-a-dozen men where only one should be, can be a good thing for any one of the half-dozen. Now we have been told to-day that it is rather an advantage to the community to have four flatted houses instead of one. It has been stated here that it is possible to have upon a square acre of ground upwards of one thousand people living in health. But I very much doubt that. I admit that with your model dwellings in London you may so pack the people, but you must at the same time see that they are a model people you are dealing with, that there is no drunkenness permitted there—nothing to disturb the equanimity of life—that all things are moving in perfect regularity. Under these conditions you may have a good deal of health, even when packed so close as that. But where you have people packed at the rate of one thousand on the acre you must have an enormous surrounding of open space. In none of our Scotch towns have we that open space. We have (I think most unfortunately) got into the system of having our dwellings in flats, and with the greatest bitterness of sorrow I now see the same system springing up in some of your towns in the

south. Depend upon it you are committing an enormous mistake. The cottage system of dwellings that you have hitherto had in England is without doubt the right one, both from a moral and from the physical point of view. We know the evils of the flatted system here, and so I earnestly hope that you in the south may take warning in time before you proceed any further. Well, ladies and gentlemen, I daresay if I had been speaking in our Town Council I would have been called to order as having departed somewhat from the subject. But you will observe that if my suggestion is to be taken of pointing out sites for our future towns, and giving instructions to the building regulations, my remarks are not in that view inappropriate. Coming back now to the object of my rising, I second, most heartily, the vote of thanks to Dr. Richardson, which with so much grace has been moved by our chairman.

Dr. RICHARDSON: I am indebted to you for the kind way in which you have received the resolution proposed by Professor Humphry and seconded by the Lord Provost. I should say with reference to a letter I have received from Mr. Chadwick, who is the great representative of sanitary science in this country, that there is a bit of curious history connected with this lecture. I sent him a proof, and he has sent me a letter, in which he states that with Bentham, who is the author of the word "utilitarianism," he was half a century ago discussing the propriety of that term. Mr. Chadwick suggested "felicitarianism" as a better word than utilitarianism, and so he adds, "You have by a happy thought come again upon the old track. I should like to see that word introduced instead of the other. Bentham seemed inclined at first to change the word; but afterwards went back to 'utilitarianism.' Infelicitarianism is the rule of ignorance, and felicitarianism is the rule of science." I am prepared to stand by what I said. I have no doubt that if drink and tobacco were removed we would be happier. But I conceded much when I said they have their effects—they give temporary felicity. It is only when considering the subject from a broad point of view that we see that for our real felicity we would be better without them. With regard to tobacco, I think my statement is fairly proved, for our young women and children are happier than the men who smoke. With respect to wine, we may all come to the conclusion that the disadvantages and miseries more than counterbalance any of that brief and temporary joy which everybody declares he experiences when he takes wine in moderation. I do not retract what I said with regard to tea. I do not think it is fitted to promote happiness. It makes many miserable. As to love, I only said "insane love." I admired the cleverness with which the learned President left out that word. I think you will see, when you read my lecture, that as leading towards the development of the purest and most perfect love the essay was written. I only protested against the insane love which leads young people to contract foolish marriages. You will all agree that is a kind of love which is better left out of court.

PUBLIC HEALTH A WORKING MAN'S QUESTION.

ADDRESS TO THE WORKING CLASSES.

By Alfred Carpenter, M.D. Lond., C.S.S. Camb.

My Lord Provost, Ladies and Gentlemen, men and women of Glasgow, I must say a word upon that Report* which has been read, if you please. I wish you to understand very specially the position that the judges occupy in connection with this exhibition. Those judges are competent men, men of the highest position in their different professional ranks; they have given their services to the work that they have taken in hand, without fee or reward, and they are only inspired by an honest desire to do their duty. It has been supposed that in exhibitions of the kind which have just been held by the Institute—which have also been held in different parts of the country—the judges, as a matter of course, have given their awards, whether the subjects have been worthy of the medal or the certificate, or not, but I can assure you that so far as this exhibition is concerned, and any other exhibition which has been held by the Sanitary Institute, if there is an award given it is richly and properly deserved.

Having made those observations with regard to the judges, perhaps you will allow me to make a remark or two with regard to myself.

I appear before you as chairman of the Council of the Sanitary Institute. I am not the great Dr. Carpenter who is the philosopher and physiologist, but I am the Dr. Carpenter who is only the family doctor, and who has been a working man all his life, with regard to and in connection with the prevention and the cure of disease. I am the Dr. Carpenter who has been before the electors as a member of a civic council in a certain part of Great Britain, where sanitary science has been specially and practically studied. One of the results of the action of that sanitary authority has been to reduce the death-rate of the district in which I reside from 28 to 17.

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* Report of the Judges, see page 394.

Now, you know there are sanitarians and sanitarians. There are a great number of men who have come before the public as sanitary authorities, but let me tell you that sanitary science is one of the most intricate sciences that is possible to follow, because it requires deep study and very great care in coming to conclusions, and still greater care in acting upon those conclusions. If a man follows that science carefully, and with a conscientious desire to do what is right with regard to the people to whom those sanitary laws are to be applied, you may depend upon it that it cannot be done by any royal road. I wish you to understand that point very specially, he can no more at once blossom out into a sanitary authority, than a man acting as a pilot upon one of your steamers can the first time he takes charge of a vessel without previous study of the chart, keep that vessel in safe channel, because he would certainly put her upon the rocks, and cause her to be wrecked.

Now, a statement is frequently made that sanitary science has nothing particularly to do with the working man. I want to show you—and I think, before I have finished, I shall have shown you very conclusively—that it is in a great measure a working man's question; that he has more interest in the health of a given district than any other class of people who live in it. It does affect him excessively. It is a serious question to him whether the health of that district is good or bad. The rich man, the professional man, and the merchant can take their wives and family to the coast or into the country if any epidemic visits the city. At this particular season the Glasgow professional man generally sends away his wife and family to different parts of the country, and the working man is left. The poor man must reside near his work, he must keep to his work or else he will lose it altogether. I draw your attention to what the Lord Provost has explained with regard to professional men and merchants; they can get away from the city and take their wives and families with them, but the working men must remain in it, and, therefore, it is very important for you who are the working men of the city that the health of Glasgow shall be of the very first character, instead, as it has been in the past, namely, that of being one of the most unhealthy cities in the kingdom.

Let me now take you for a moment or two to the era before 1832. You know the cholera was then upon you, and you suffered seriously from it. Still more so in 1848, I recollect that very well, because at that time I was deprived of the advantage of listening to the lectures of my worthy master—Richard Grainger—for he was down in Glasgow, studying the nature of cholera under which you were then labouring. I have the greatest regard for Glasgow, because when Richard

Grainger came back from the city, and brought to our hospital some of the evidences of cholera, and the results of his labours, and showed us as students that we need not be afraid of it, that it was a disease which would not have arisen if the sanitary conditions had been what they ought to be; and he further showed us that it was more preferable to prevent disease than to cure it—that it was far better to prevent the onset of an epidemic than to quell it after it had arisen.

You know that you had the epidemic again in 1854, and the result of that epidemic with other causes was to overcome the incubus of a mistaken economy in your town council, the cry of expense, and to lead to the introduction into Glasgow of your Lock Katrine water, which is now the envy and the desire of other places. Is Glasgow any the worse for the one million pounds that were expended to bring Loch Katrine into your midst? Has it not been a tower of strength to the people of Glasgow? Has it not helped to increase your trade? Has it not helped to increase the prosperity of the place to a much larger extent than is represented by the expenditure which was required to bring the water? may we not look back to some extent, and give some heed to the different kinds of statements which were made by certain parties in Glasgow, when it was proposed to bring that water into your midst? These same parties, or their successors, are now the great opponents of sanitary works of every kind.

While I am upon this question, I want to tell you a little experience of my own, and I want to apply it in another way if you will allow me to be a little personal. In the district in which I reside we had great difficulties with our water supply. We had an intermittent supply, imperfect fittings, and, in short, we had a condition of things which was most unsatisfactory to those who had paid any atttention to sanitary subjects. I was chairman of the Water Committee, and I had impressed upon my colleagues in the Council, that whilst our fittings were of the kind that existed, whilst we had the water supply as it was, we were in the greatest danger, we were liable to the incidents of disease of a severe character, and I, for one, was very unwilling to rest under that incubus, I persuaded my committee to agree to recommend certain alterations in the fittings, but at that time it happened that my term of office expired, and I was again before the electors. Well, what happened? The owners of property went amongst the electors in that district and said to them, "Mind, if you vote for Carpenter, and those alterations are carried out which he suggests, we shall be obliged to raise your rents." Now here was a stinging observation, addressed to the working men and the others occupying the small proper-

ties in Croydon, and especially to the tradesmen. They voted against me, and instead of being at the top of the poll, as I generally had been in previous elections, I found myself at the bottom.

Well, I was out of the Council, and my successor in the chairmanship of the Water Committee said, "Now see what a mess we have made in following that fellow's directions. We cannot go on in these lines, the public is against us; we must continue in our old plans." They did go back to the old plans, and the result of continuing them was the continuance of fever and other illness, occasionally to a serious extent. Well, the year did not pass over before the gentleman who had been put into the Council in my place departed this life, and there was a vacancy. I was requested to fill that, but I declined. I said, no; when the electors want me they shall put me on the Council of their own free will again. It happened that at the following election I was returned again upon the Council, and I then endeavoured to get the condition of things altered. That—the condition of the water-supply—was to me a very serious trouble. Well, it required time—it required a great deal more time and expense than would have been the case if they had carried out the resolutions that had already been agreed to. Before it could be done, I had to convince two or three members of the Council that public opinion was not against them, because, while public opinion was not in favour of getting the water-supply into a satisfactory condition, they were not willing to go in the way in which I wanted them for fear of losing their seats. Well, things got worse with regard to the point of health, and eventually I took the liberty of suggesting to the Council, amid a storm of indignant protests, that we were in the midst of an epidemic of fever, and that the character of the fittings connected with the water-supply was at the bottom of it, and I predicted at least a thousand cases. Before very long one thousand cases had occurred in that district. I was accused of being an alarmist, and doing serious injury to the town and to the trade—a vote of censure was moved against me in the Council by the Chairman of the Water Committee—you know how they treat people like me, I need not tell you. Instead of 1,000 cases of fever the number soon run up to 1260 cases, and there were 78 deaths.

It was then that the Council came round to my views and thinking, and altered the character of the water fittings, and did put on that four or five pounds per house of expense that was absolutely necessary, and they had to do it during its continuance, and after the epidemic had subsided, and which, if they had done when I first proposed it, would have been prevented, and very valuable lives would have been saved.

What was the case with regard to that epidemic? It did not affect the poor. It was amongst the rich, the so-called respectable classes that nearly all those cases of fever occurred. When the voting papers went out for the election of members upon the Council, they were returned by those people unsigned. They would not take the trouble to do their duty as citizens, and left me out in the cold. The result was undoubtedly the great increase of that epidemic of typhoid fever to which I have alluded. Well, I have spoken of typhoid fever in connection with water supply, but there are other ways in which the health of the people is affected, and its result is shown in what are called the death-rates of a district. Now, do you know what death-rates mean? It is said that so many persons in every thousand living in the district die in the course of the year. For instance, there are times in which Glasgow has had a death-rate of 36, 35, 33 and 32, these numbers being multiplied by so many as there are thousands, according to the number of the population; happily last year it was only 25 or 26. Well, there are places in Glasgow where, according to the reports of your officials, the mortality has been 50 and 60 per thousand in the course of the year. Do you know what that death-rate means? It does not mean simply that so many people have died: for every one who has died 20 have been laid upon their backs with sickness in the course of the year. For every one who has died in a healthy district—I take my own district—there have been two, on an average, on a bed of sickness every day throughout the whole year. Now, if you will only consider that point you will see that the bearing of the death-rate of a district has immense influence upon the prosperity of working men. If you have a mortality of 36 in the thousand that means 72 persons in that thousand on a bed of sickness every day during the whole year. But if you reduce that death-rate, as you have done in Glasgow, from 36, you will see what an enormous saving there has been to the working men of Glasgow by the introduction of that grand water supply into your midst, and by the various measures that are being carried out by your municipal authorities for the purification of your city. The question of how many deaths have taken place is one thing, but the question of how much sickness, how much suffering, how much infelicity there has been amongst the people, is something very much larger than that which has been proved by the death-rate. Now taking the annual average of seven days' sickness for a working man—and I will tell you how I get my average—it is from a study of the great benefit societies, like the Oddfellows and Foresters—societies which have branches in Glasgow as well as in all other

parts of the kingdom, you will see its bearing upon your welfare and your pocket.

In my own district, from examination of their returns, I find that every member in a benefit society, on the average, suffers seven days' sickness, and draws seven days' sick pay every year. I do not know what the average is in Glasgow, but I combine that seven days' sickness with a death-rate of 16. Now there is a district that I have been inquiring into, containing a certain manufactory which is reported to be of an unhealthy character—where the workmen are thought by outsiders to be following an unhealthy trade. Now that factory has a benefit society of its own. All the members, or, at least, all who like—it is not compulsory—pay into the sick fund, which is managed by themselves, totally independent of the proprietors of the mills. They pay sixpence per week to this sick fund, and at the end of the year they divide amongst themselves what surplus is left. Now, they belong to this sick fund whether they are in other clubs or not, but this has happened with regard to that club, for I have examined the accounts as they have been prepared for their own purposes. They had nothing to do with the object I had in view in making an examination, and therefore they are honest and straightforward accounts of the amount of sickness that those members suffered from. Well, I find that in that club and in that factory, which I am bound to say is managed on strictly sanitary principals, the amount of sick pay that has been paid during the last two and a half years has only been three and a half days per annum per member. Now, just recollect the saving to the working man in the year from not being laid upon his back and drawing sick pay. Instead of seven days sickness, as is the case in all other parts of our district, he has only three and a half days, on the average, for the last two and a half years. Is not that a saving to the working man? Is it not a saving to his wife and family because he has not suffered sickness? I believe, in a corresponding way, his wife and family have been saved in a similar proportion. Yet we are told that the question of public health and the consideration of death-rates has no interest for the working men? I tell you it is the most important question that they can possibly consider. Now, recollect, take the seven days I have mentioned as the average in London, and reduce it to six, or raise it to eight or nine, as probably nearer the case in Glasgow, what is the result? Say there are 50,000 members in the benefit societies in Glasgow and neighbourhood, put this at seven days' sickness and you have 350,000 days' sickness which the members of the societies draw pay for. Make the condition

of the district healthy and you may reduce that by the simple fall of one per 1000 in the death-rate—from 26 to 25 or 24 in the thousand, and you will save to these working men 100,000 days of sick pay, and you will give them the wages they are earning for their work in its place. Is not that a question of the greatest importance to the working men to consider, rather than to consider paltry things that are so frequently put before you, and that this or that expenditure, which is made for the purpose of promoting public health, is adding to the local rates? When a man, therefore, comes before you for the purpose of representing you, and talks to you about the high salaries paid to your sanitary officials, or talks about the great expenditure made in cleansing, and says he is anxious to go into the Council to keep down the rates, and to serve your interests, do not vote for that man; depend upon it, he is not the working man's friend. That is not the man to represent your interest in the Council; the man who does that has his own interest to serve, and not the interests of his fellow-men, and the objection to the officials arises from the latter doing their duty on your behalf, and making a shoe pinch which you do not see.

We heard the other night a great deal from Dr. Richardson about the felicity of sanitation. Now, we know very well that these hundred thousand days of sickness are not days of felicity. Reduce your death-rate by two in the thousand, and see the amount of felicity that you add to your people. Why should the working man from the north of Scotland, where the death-rate is only 17 in the thousand, come into Glasgow where it is 25 or 26, and strike out ten years of his life? Why should he destroy one-third of his family by going to reside in Glasgow, if he remained in the north of Scotland, or in the neighbourhood of London he might keep them with him? Why should a man and his family, going into a certain town where there is only a death-rate of 13 or 15 per thousand, have so many years added to their lives, whilst so many are taken from them if they come to Glasgow? I am not speaking in any kind of condemnation of the Glasgow authorities, because they have done their duty wonderfully in connection with this great city. They have had most superhuman work to perform, and these they have performed remarkably well, inasmuch as they have reduced the death-rate from 35 or 36 to what it is now. Therefore, I say all honour to these men. We want you to give them good God speed upon their journey, and encouragement so that they should not rest contented until they have brought that death-rate down to what it is in London. I think the men of this metropolis of commerce have a desire to beat London. I think, if I am not mistaken, they have not

only the desire, but with your assistance, they have also the power to beat London, because you have advantages which London does not possess. Now, I wish just to refer to some of these causes which are said to increase your mortality. I recollect being here in 1874, and hearing a paper read, I think by Bailie Morrison, in which he stated different causes for the high mortality in Glasgow. It was much higher then than it is now. He said that character and occupation had something to do with mortality. Well, it might have something to with it under the circumstances which then existed, but it was not necessary. Character and occupation are not reasons at all for a high mortality. Take poverty, for instance. Recall, as I do, the time of the cotton famine. There was no healthier period in the cotton districts than during that time. Why was it that the poverty of the people was accompanied by a far better state of health than when they were in the full flush of work? Why is it that plenty of work, plenty of wages, gives rise to a higher mortality? I am telling you that which is a positive fact. It is a very serious thing to reflect that the more prosperous Glasgow is, *pari passu*, the higher is the mortality amongst you. Character may have something to do with it, but men are not vicious and diseased from choice. They are not accustomed to go wrong simply because they prefer that kind of way. You may depend upon it, it is more frequently than not, that those who go wrong are more to be pittied than blamed. I speak of the poor uneducated portion of the population. They are far more to be pitied than blamed when they do go wrong, because the local conditions very frequently prevent them from going right.

I have been reading the Glasgow papers, and I have heard something of the lawlessness in the Sixth Ward. I suspect that if I were to make some examination of that Ward, I should find out that the lawlessness has something to do with the housing of the people; something to do in the way in which they live; something to do with the manners and customs that arise from the fact, mentioned by the Lord Provost, that a large proportion of these people are living in one room. I have no doubt there is some connection between the lawlessness of a district and overcrowding, just as there is a connection between it and the lawlessness of the people in my own district, and the crimes and disturbances that take place there. I know it from personal experience, from having to sit in judgment upon those who are accustomed to transgress the law in those overcrowded districts. But overcrowding is not a complete reason for a high death-rate, for I know districts in London which are as overcrowded as Bridge Gate, High Street, The

Wynds and The Closes—places where we have more than one thousand persons to the acre, just as you had in some districts which I recollect seeing here in 1874. But happily many of these densely populated and filthy habitations have been cleared away. We have districts in London which are as densely occupied as these were, but with a death-rate of only 14 per thousand. Why is that? I can tell you. It is that nearly the whole of the occupants are total abstainers, and their houses are in a good sanitary condition. Take Shaftesbury Park Estate, named after that noble statesman who has done so much for the people of this land—take that estate which is thickly peopled, there is not a public-house upon it, and the result has been that the health in connection with some other points—I do not impute all to the absence of the public-house —is vastly improved in those dwellings. The same remark is applicable to the dwellings erected by the Peabody Trustees, and the same results have taken place in the dwellings erected by Sir Sydney Waterlow and his friends. There it has been shown that correct principles of sanitation in connection with dwelling houses bring about a wonderful state of public health, notwithstanding the density of population, especially if it be associated with absence of drinking shops. How do I account for the circumstances of your high death-rate. Well, there are two circumstances over which you have no control. One of these, to my mind, is that your houses are built of stone. These stone houses are not pervious to air in the same way as the houses of the jerry builders which we have in London and neighbourhood. Some houses in which our poor live are such that the wind can blow through every brick..

There are many mischevious results, in one sense, from that kind of house, but there is also a great advantage in another, because the air will find its way in and the people cannot keep it out. That is not the case with the houses of Glasgow. They have solid stone walls which no air can penetrate. I am afraid that in many instances they take care to shut up every crank and cranny through which the fresh air can find its way. One result is that the foulest of air is kept in the apartments in which you live. I have a proof of the fact, inasmuch as I read from the evidence of your highly-advanced officials, that the effect of cold air upon the inhabitants of Glasgow is shown in an immediate rise of the death-rate. Why is that? Why should Glasgow have a high death-rate from the influence of cold, whilst other districts around the city, exposed more to the cold, do not suffer in the same way? It is because you keep out the cold air, and the walls will not allow fresh air to come in, and you stop up all the openings through which air might get in.

If you keep your wives and families in these badly ventilated apartments, the result is, that when the cold weather comes on it checks an action established in the body for the purpose of throwing off morbid matter which exists in the constitution, and in the fight life is frequently lost. But there is another circumstance over which you have control, and that is not to shut out fresh air from your buildings. Let there be fresh air; do not be afraid of it, no harm will arise to you. With regard to myself, no matter where I am, I always sleep with my bedroom window a little down. I am not going to recommend that practice to everyone, because there might be circumstances which may make that impolitic; but, as a rule, those who sleep in a pure atmosphere will not be troubled with headaches in the morning, that is, if they have not been in the whisky shops over night. They will enjoy their breakfast without having any nasty taste in their mouths. One of the inducements to enter a whisky shop so early in the morning, and so frequently, in Glasgow, is the foul air in which the people live; if you want to stem the torrent of intemperance you must ventilate your sleeping rooms.

There is one other reason mentioned by Bailie Morrison, viz. the high infant mortality. I find from the evidence that, speaking generally, 13 per cent. of all babies who are born in Glasgow die in the first year of their lives, and that nearly half of all the children who are born do not reach the sixth year of their existence. Now, is not that a sad state of things—that nearly half of all your children are put under the ground before they reach their sixth year? That is not so in the healthy districts of the kingdom. The mortality of a school with which I am connected, and in which there are 900 orphans and others belonging to the parochial authorities of the South of London, is not more than two or three in the thousand. These children have been left orphans or deserted by their parents, and are taken charge of by the parish authorities, and brought up in this school under the simplest arrangements with regard to food and clothing. They have enough and no more, yet, as I have said, the mortality is now two or three in the thousand. Why should 50 per cent. of the children of Glasgow die before their time, whilst not one-twentieth of that number die if the children are taken care of by parish authorities elsewhere? It is because of all those evils of which I have spoken—the foul air to which they are exposed, the bad influences with regard to food to which they are subjected, and, worse than all, the whisky poured down the throats of their fathers and mothers. The money which should go for food to the children is too often consumed by the depraved fathers and mothers in drink for themselves.

There is another reason why you are not quite so well off from one of your great advantages as you might be, namely your pure water. It is not a trouble to the poor man, but I think to the wealthy citizens of Glasgow a serious evil follows from its very purity; because the purer the water, the more absorbent it becomes. If it is exposed in your houses, and allowed to come into contact with the air before it is consumed, it will imbibe foul matters from the atmosphere, and may be dangerous to health. Thus the very purity of the water is a source of danger. I am going to tell you how to get rid of that danger. It is said that Parliament may give a man a vote. Quite true. I have great respect and regard for the voters of Glasgow, because they do honour to my profession by returning to Parliament a member of the medical profession as one of their representatives. I, therefore, believe that there is a great deal of intellect amongst the working men of this city. There is one thing that I would say—that knowledge is power, and undoubtedly it is the right arm of democracy. The knowledge that belongs to democracy is power, and when that power is exercised in the right way, and for righteous purposes, it will make the people far happier, far more powerful and prosperous than any other power they can exert, and the more knowledge they get the more powerful they will become, provided it be not used for evil, but for good, not for the destruction of the country, but for establishing and raising it to a higher level in the scale of nations. Parliament may give a man a vote, but it cannot give him a comfortable home. The comfortable home must be got by your own exertions and by attention to those principles which the Sanitary Institute would teach you, and these things are not to be learned at once; they are only to be learned by steady attention to the rules which are given by those men who have made sanitary science their life-long study. When, therefore, your eminent medical officer gives you instructions with regard to certain conditions to which your houses are exposed, you should give him an attentive ear. I have, in this excellent pamphlet that is before me, "The Dicennial Census and Memorandum, and a Report upon the Hospital Accommodation for Infectious Diseases in Glasgow," these instructions. I know that you have in him a giant with regard to sanitary work, and I urge you to follow these instructions. He gives you information that should prevent overcrowding. Mind, overcrowding means also something much more serious. It means diversion of income to whiskey. If I went into these rooms where there is overcrowding, where men are content to live in one room, I should find that many spend a great deal of their wages in drink. They

go to the whiskey shop because they have no comfort at home. I advise you to let the whiskey shop alone. I have been a follower of abstinence for many years, and have, as a medical man, practised in a large district amongst people of all ranks, and I can tell you that whiskey and such drinks may be very excellent medicines, but they are dangerous and poisonous foods. Don't be afraid of investing some of your income in more house accommodation. I will grant it may be possible to live healthy and well in one room under certain circumstances—with abundance of ventilation and great attention to the proper principles that should regulate health. But I cannot conceive it possible in your stone houses, without the ventilation being very excessive, that you can live, sleep, wash—if you do wash there—cook your food, and do all the duties and all the offices that belong to human nature, and at the same time keep healthy. There is another phase in the history of the working classes of Glasgow. It was mentioned by the Lord Provost, namely, the large sum invested by them in the savings bank. Indeed, they have saved on the average per head more in that way than the working classes of any other place in the kingdom. There is certainly no other city or district where more than three millions have been banked by the working classes. But don't let thrift deprive your wife and children of more house accommodation. There is an old saying which is taken from Holy Writ—"There is that which scattereth and yet increaseth; and there is that which withholdeth more than is meet, but it tendeth to poverty." I know of nothing that tends more to poverty than that kind of thrift; for the saving may be carried out at the expense of the life blood of your brothers, and sisters, your wife and children. Purity of air is a factor in promoting health, and in promoting felicity. I will not say you may not have a morbid sort of feeling which you may call felicity, and which that man has who has taken rather more liquor than is good for him. He says, "I am very happy." That may be felicity or not; but generally he does not find it so next morning. I think you had better let that sort of happiness alone.

There is another thing that promotes felicity, namely, good cooking. Depend upon it, good food and bad air cannot go together. If you have good food and bad air you will not have the full advantage of the food you ought to have; indeed, more serious effects will arise from having plenty of food than having less of it, and unless you have proper cooking you cannot have a healthy digestion. Now, here every one of you may assist in promoting the purity of your atmosphere. The 130,000 domestic hearths in Glasgow pour into the atmosphere a large quantity

of smoke which helps to render it impure. If you could look at some of the gas-cooking apparatus in the Burnbank exhibition, and get your landlord to give you one, you would be able to cook cheaper, and help to diminish the impurity of the atmosphere which is doing great injury to the citizens.

I have been privileged to take a run down the Clyde to-day. I was astonished to see the immense volumes of oily smoke that your chimney stacks and your steamers poured out. I hold that your steamboat and factory owners have no more right to pollute the atmosphere which we breathe, than you have to pollute the stream that is running through the estate of one of your riparian landlords near Glasgow. I think that public opinion of Glasgow shotuld insist upon this nuisance being stopped—in demanding this you are doing no injury to the delinquents. I am satisfied that if the steamboat and factory owners were compelled to consume their own smoke, the tons of carbon and oil which they send into the atmosphere every day would amply repay them, and then you would have that pure atmosphere which is so necessary to health and enjoyment. I speak feelingly upon this matter. I live in a district ten miles from London, and whenever the wind comes from the north, there is sent down upon my district a cloud of smoke which people with the least chest complication at once feel. Hence the death-rate rises just as the wind blows from that quarter, and vegetation is also injured. I feel it must be so in Glasgow and neighbourhood, therefore, you, as the electors of the Town Council of Glasgow ought to insist upon your representatives taking this matter in hand, and upon the law being put into force with reference to those matters to which I have alluded.

I might have said something more to you with regard to the death rates. I might have told you that there are places where the death rate used to be high, but where the action of the authorities has brought it down to a very low standard. There is the army, you know. I don't know whether my friend Dr. De Chaumont is present, who has done so much to reduce the death rate of the army, but he will bear me out when I say, that each soldier existing in Her Majesty's army has cost on an average £100 to whip him out of the raw material of the recruit, till he is fit to go into the line as a properly drilled soldier Years ago, the death rate in the army was very great, and not very long ago the death rate at Gibraltar, for instance, was 21½ in the thousand. Now, by the introduction of sanitary measures under the supervision of the medical officers from Netley, who have been educated by Dr. De Chaumont or his predecessors and his colleagues, the death rate is only 5½. Look at the wonderful saving by this to the country. The death

rate of the London Police is only five in the thousand, and in the army nine per thousand. The death rate in the navy is $6\frac{9}{10}$. Why should the death rate in the navy be less than the army? Because the soldiers are more exposed to the influences of the whisky shops and gin palaces than the sailors are. The difference of mortality between the army and the navy amounts to more than two in the thousand, mainly from the very circumstance that one can get to the gin shop more frequently than the other. There is another circumstance that one ought to mention more in detail, that is the mortality of your children. I find from experience and from the examination of the reports, that some of you are very thrifty and careful with regard to your children. You go so far as to insure their lives, so that if they die, you may have money to bury them. Well, I don't suppose that many are present who have been in the habit of doing this for the sake of the money, because I take it those who have come here to listen to me are anxious to know something about sanitary matters, and have thought a little about them; but it appears to me that those who have insured their babies, have thought more about the certainty of their deaths from the insanitary surroundings than from having any care to try and keep them alive, because I find $22\frac{1}{2}$ per cent. of the children who have died under five years of age are insured. It is an unfortunate phase in human nature that this should be so. I think there should be a great care on the part of the people not to encourage the insurance of children's lives against death, because children ought not to die in the way in which they do, and you would be doing the right thing if you would take more care to prevent them going than to insure their lives and bury them when they do go.

I am afraid you will be tired hearing me talk; but there are two or three other things I would like to mention to you. One is with reference to the advantage of sanitary operations in saving life, and in saving you from the consequences of sickness, because it may encourage you still further in your thrifty habits. I wish to point out that with reference to savings banks, if you can reduce the mortality of your district from 26 in the thousand to, say, 18, you will effect such a saving that, without any kind of arrangement of your own, except putting aside money that has been saved, so that when you reach sixty years of age, you can retire with an annuity for the rest of your life of 10s. per week. That can be effected if you pay into the post office savings bank 7s. per month from the age of twenty-five to sixty. You will see, if you can persuade your authorities here to take such measures as will reduce their death-rate from what it is down to the figure I have mentioned, you may every one of you save

that amount which will secure you 10s. a week for the rest of your lives when you reach the age of sixty years. Now, is not the public health a working man's question? Such being the state of the case, is it not important that you should consider this subject very seriously; and I want you to consider it in this way—something after the light of a little circumstance which happened some years ago to a distinguished individual connected with the Court of this land. He made a remark that the Lord Chamberlain's wand was a simple stick of polished deal which cost one shilling, and he had been examining the accounts of some civic entertainment, and he found that every one of the wands had cost about two guineas. He asked the reason why such a large sum should be paid for a wand in the city, whilst the Lord Chamberlain's at her Majesty's drawing-room only cost one shilling? The answer was this. The Lord Chamberlain gives the dignity to the wand; but the gentlemen who officiated in the city had dignity conferred upon them by the very handsome wand that they had to carry. Gentlemen, when these matters come before you, vote for the men who won't have the dignity of the wand conferred upon them, but who, from their education and knowledge of sanitary work, will give dignity to the wand; who will take the men into their confidence who have shown that they studied the state of public health, and by their knowledge of other matters conferred dignity upon the work. If you do your duty with reference to this great question, and not be led away by clap-trap by men who are so anxious to keep down rates, you will find that you will not be one of those persons spoken of in Holy Writ, who saved when spending would have brought a much greater return to them.

And now I want to say a word or two upon another subject, the one which Dr. Angus Smith dwelt upon yesterday. He told us that the waste of ammonia that was going on in connection with the city of Glasgow amounted to £1,000 per day. £360,000 of wealth is lost every year to the country from the way in which your own noble river is being turned into a common sewer. I am not going to tell you that the common sewer is at this time unwholesome and producing mischief in your midst. I question whether it is so dangerous as some of your closed sewers that are introduced into some parts of the town, and which may be simply sewers of deposit. The immense traffic upon your river, the constant stirring up by the screws and paddles of your steamers, and the rise and fall of the tide, keep up that motion in the river which is so essential to prevent mischief arising in you midst; but if by any chance your steamers were to become motionless, the

trade of your town to be seriously damaged, and the Clyde less stirred up, then a mischief would arise some day, sooner or later, to this city. You can adopt a plan to prevent that mischief — a plan which is wrought successfully in the district to which I belong. There is nothing that the Glasgow men determine upon but they have the energy to carry out. Machinery could accomplish the work, and your sewage could be taken out of the Clyde as easily as you brought in the Loch Katrine waters to the city. The sewage is in its wrong place. If you put it into the cultivation of crops in your own country, you will be doing a very great good, instead of doing, as at present, a very great harm, and depriving your country of the ammonia which the sewage contains.

"There is that scattereth and yet increaseth, and there is he that withholdeth more than is meet, but it tendeth to poverty." This question is undoubtedly a poor man's question, because if ever it should come that this country should suffer from a short supply of the provisions of life, it is the poor man that will first feel it, and what are you to do? You are throwing into the river £360,000 yearly of ammonia which ought to be somewhere on your land. Now, in my own neighbourhood there is a farm with 600 acres of land which is cultivated by sewage. Before that land was occupied it was worth 25s. per acre—agriculturally, I mean. We have had now to purchase that land at over £300 an acre, which has cost nearly £200,000 to get possession of that land and fit it for our purposes. We have made the owners of that land rich men. Before we took the ground one man was sufficient to cultivate fifty acres of the ground, but at present there is one man for every ten acres, and, therefore, you see the amount of labour that is put into the ground is multiplied to a large extent. We have also added to the rates of the parish in which that farm is situated, because it is rated at the money we have given for it—not at its former agricultural value. We have sent into our own town an enormous quantity of milk and meat produced on that sewage farm; yet the mortality in our town is under 17 per 1,000, and sometimes it is only 15. We have also produced on that farm material sufficient to raise three and a half oxen per acre instead of half an ox that it raised before we had anything to do with this farm. That has been done, not at a large cost to the ratepayers of the district. They have had their sewage utilized, and the health of the district is of the highest possible character, because there is close to it a large population with a mortality of only 14 per thousand. For some years back we have had this great produce of meat for the people, and I contend, that if the whole of the ammonia that is produced by human beings was

properly placed upon the land we should not have that meat famine which is imminent in our land, because we are now obliged to depend upon foreign countries for our meat supply. I take it that this is a very important poor man's question—a question whether the meat supply of your country shall be supplemented by the material we send to waste, or whether we will have it increased by the operation of the local authorites in connection with sewage cleansing. I want you to entertain these two questions—the purification of your atmosphere and the purification of the Clyde. These are two matters that the men of Glasgow should set their minds to. I honour Glasgow extremely for her magnificent water supply and for her well-swept streets, for utilisation in connection with those works which I witnessed the day before yesterday at St. Rollox, for your grand hospital accommodation—I say that the hospital accommodation provided by your authorities is ample, and I strongly urge the working men of Glasgow when they have got infectious diseases to take care to get Dr. Russell's assistance, and not hesitate to have their children, their wives, and themselves conveyed to those infectious hospitals as quickly as possible; because by so doing they will help yourselves materially, and help your neighbours.

I honour Glasgow for the absence of small-pox. I am told that disease is almost unknown amongst you. It is a great credit to the working men of Glasgow that that should be the case, because without their assistance I am quite sure such a result would not follow. I honour Glasgow for another thing. I understand that married women—suckling women—are not seen in your mills and factories. That is not the case in some parts of the United Kingdom. The effect upon these married women and nursing women is great, and it is much credit to you that these women should not be allowed to work in your factories. I also honour Glasgow for one or two other circumstances—minor circumstances—that you don't allow houses to be occupied until they have been pronounced fit for habitation. These are things which lead me to honour Glasgow. Your Town Council is not parsimonious in connection with sanitary work. I take it that the electors of Glasgow are not altogether parsimonious. I trust in the future they will be still more liberal than they have been in the past in connection with these matters. If I shall have the glorious opportunity of again coming amongst you I may hope to tell you that your reduced death-rate has followed from carrying out these works I have mentioned, and that you will then come, with regard to health, to occupy the same position as you do with regard to the commerce of the Empire, viz., the first place.

Let not the great intellect that does exist in the Scotch character in Glasgow be blunted by the fear of expense in connection with these matters, but do be determined that you will have these changes carried out which I have mentioned, at whatever cost. I am certain that the day will come when you will find that the money spent has been returned to you, in the same way as the money has been returned to you, over and over again, which you invested in the Loch Katrine supply.

I thank you most heartily for the kind attention you have given to my observations. I beg just to say, in conclusion, that although I appear here as the Chairman of the Council of the Sanitary Institute, these views are mine alone, and not necessarily the views of the Sanitary Institute itself. On some points there may be individual differences on point of detail, but with regard to the principles upon which those views are founded, I am quite certain that they have the support of the Institute.

REPORT OF THE JUDGES OF THE EXHIBITION, NEWCASTLE-UPON-TYNE, 1882.

SUPPLEMENT.

MEDALS AND CERTIFICATES.

Awarded to Exhibits deferred for further practical trial at the Exhibition at Newcastle, 1882.

MEDALS.

DOULTON & Co., *London*, for Anti-percussion Ball-valve.
ROBERTS, CHARLES G., *Haslemere*, for Buck's Automatic Rain Water Separator.
SANITAS COMPANY (LIMITED), *London*, for Sanitas Oil.

CERTIFICATES.

ANTISEPTIC APPARATUS MANUFACTURING COMPANY, *London*, for Red Cross Antiseptic Fluid.
BRITISH & FOREIGN MINERAL WATERS COMPANY, *Glasgow*, for Potash, Soda, and Seltzer Waters and Lemonade.
EDMUNDS, J., *London*, for Currie Powders.
IRVINE & Co., *Gateshead*, for Mustard.
KITE, C. & Co., *London*, for Outlet Ventilator.
MAIGNEN, P. A., *London*, for Improved Filtre Rapide.

REPORT ON NON-POISONOUS PAINTS. CONGRESS AT GLASGOW, 1883.

THE question of poisoning by the use of lead paints is one of such great importance to all classes of the community, that the Council have considered it advisable to submit to the Congress a Report, which was made a short time before the present Congress by a Committee specially appointed to consider the matter, in consequence of circumstances which arose at the Exhibition at Newcastle in 1882.

REPORT TO THE COUNCIL OF THE SANITARY INSTITUTE.

WE, the Sub-Committee of the Judges appointed to make an investigation into the composition and properties of non-poisonous white paints, and their driers, more especially as to the presence or absence of lead, beg to report as follows:—We have examined three different non-poisonous white paints, and the driers supplied with them, and we have found that, although all the paints are practically free from lead, two out of the three driers supplied with them contain lead in large quantities. The Committee would call special attention to this fact, for, although according to the directions of the makers the driers should be used in the proportion of only about 7 or 8 per cent., they are in practice mixed with the paints to a very much greater extent, and consequently the paint, when prepared for use with driers containing lead, becomes a poisonous paint. It is, therefore, essential when using a so-called non-poisonous paint, to carefully ascertain that the driers used, as well as the paint itself, are free from lead. There appears, moreover, no substantial reason for the use of lead driers, for in the only instance in which the paint and driers were both free from lead, the result obtained in the trials made to ascertain the comparative merits of the different paints for decorative purposes, was superior to either of the others.

We have not been able to continue the experiments for a sufficient m e to report upon the durability of the various paints.

W. H. CORFIELD, M.A., M.D.
H. C. BARTLETT, Ph.D., F.C.S.
ERNEST TURNER, F.R.I.B.A.

REPORT OF THE JUDGES OF THE EXHIBITION, GLASGOW, 1883.

We, the undersigned, the Judges appointed by the Council, beg leave to recommend to the Council the following distribution of Medals and Special Certificates, and of Certificates of Merit.

Exhibits which have already received Medals at previous Exhibitions of the Institute are excluded from awards of Medals, but those Exhibits to which a second Medal would otherwise be awarded receive Special Certificates, and these are distinguished in the following list by asterisks.

MEDALS AND SPECIAL CERTIFICATES.

We recommend that Medals or Special Certificates should be awarded to the undermentioned exhibitors:—

CLASS I.—CONSTRUCTION AND MACHINERY.

ORR, J. B., & Co., *Charlton, London*, for Leadless "Charlton White" Paint and Dryers.
SCOTTISH ASBESTOS Co., *Glasgow*, for Scottish Asbestos.
ALUMINIUM CROWN METAL Co., *Glasgow*, for Aluminium Crown Metal.
DICK, ALEX., *London*, for Delta Metal.
*BRADFORD & Co., *Manchester*, for Washing Machines.

CLASS II.—SEWERAGE AND WATER SUPPLY.

*BRITISH SANITARY Co., *Glasgow*, for Improved Self-acting Earth-Closets.
HEAP, R. R., *Manchester*, for Dry Earth or Ashes Closet.
BUCHAN, W. P., *Glasgow*, for his exhibit of Sanitary Appliances.
STEWART, J., SEN., *Glasgow*, for his exhibit of Stoneware Disconnecting Traps.
*DOULTON & Co., *Lambeth, London*, for Anti-percussion High-pressure Valves.
CLIFF, JOSEPH, & SONS, *Leeds*, for Porcelain Bath.
HALL, JOHN, & Co., *Stourbridge*, for Fire Clay Enamelled Bath.
*ROBERTS, C. G., *Haslemere, Surrey*, for Automatic Rain-water Separator.

MORRISON, W. B., *Glasgow*, for Wedgwood Ornamental Tiles.
*STEWART, J., Sen., *Glasgow*, for Stoneware Pipes with Stanford's Joint.

CLASS III.—HEATING, LIGHTING, AND VENTILATING.

*DOULTON & Co., *Lambeth, London*, for Ventilating Tile Stove.
KEITH, J., *London & Edinburgh*, for Challenge Hot-water Boiler.
SHAW, A., & SON, *Glasgow*, for "Sine quâ non" Open and Close Fire Range.
WALKER, TURNBULL, & Co., *Falkirk*, for the Artizan Cooking Range.
WHYTE & BRADFORD, *Bowness*, for Cooking Range with Revolving Fire for the Prevention of Smoke.
*WILSON ENGINEERING COMPANY, *London*, for the "Wilson Cooking Range."
*BROWN, A., & Co., *Glasgow*, for the "Stott" Gas Governor.
*ELLISON, J. E., *Leeds*, for Conical Ventilators.

CLASS IV.—PERSONAL HYGIENE FOODS, FILTERS, AND DISINFECTANTS.

*CHORLTON & DUGDALE, *Manchester*, for "Excelsior" Spring Mattress.
HANCOCK, F. & C., *Dudley, Worcestershire*, for their exhibit of Machines for Domestic Use.
*MAIGNEN, P. A., *London*, for Filtre Rapide.
*CALVERT, F. C., & Co., *Manchester*, for Carbolic Acid, and Preparations from it.

CLASS V.—ARTICLES OF SANITARY INTEREST NOT INCLUDED IN THE ABOVE CLASSES.

HILLIARD, W. B., & SONS, *Glasgow*, for their exhibit of Hospital and Sick Room Appliances.
MEYER, H. C., *New York*, for the Sanitary Engineer of New York Newspaper.
WENTWORTH, F., & Co., *London*, for "Kredemnon" Life-saving Garments.

CERTIFICATES OF MERIT.

We further recommend that Certificates of Merit be awarded to the undermentioned Exhibitors:—

CLASS I.—CONSTRUCTION AND MACHINERY.

PENNYCOOK PATENT GLAZING & ENGINEERING COMPANY, *Glasgow*, for Glazing without putty.
WALTON, F., & Co., *London*, for "Lincrusta Walton."

CLASS II.—SEWERAGE AND WATER SUPPLY.

DOULTON & Co., *Lambeth, London*, for "Lambeth" Trough Closet with Automatic Flush Tank.
DOULTON & Co., *Lambeth, London*, for the "Lambeth" Flush-out Closet.
GILBERT, E. & A. E., *Broughty Ferry, Forfarshire*, for Improved Seat for Water Closets.
MORRISON, W. B., *Glasgow*, for the "National" Water-closet.
HARRISON, T. HARNETT, *Liverpool*, for Iron Basket Sewage-strainer.
BUCHAN, W. P., *Glasgow*, for Disconnecting Drain Trap.
BUCHAN, W. P., *Glasgow*, for Grease Trap for Kitchen Sinks.
CRAIG, J. & M., *Kilmarnock*, for their exhibit of Stoneware Disconnecting Traps.
STEWART, J., Sen., *Glasgow*, for Disconnecting Chamber for House Drains, with open Stoneware Channels.
CRAIG, J. & M., *Kilmarnock*, for White Enamelled Sinks.
SHANKS & Co., *Glasgow*, for Cast Iron Bath.
SHANKS & Co., *Glasgow*, for Porcelain Lavatories, with movable caps for access to fittings.
SHANKS & Co., *Glasgow*, for "Eureka" Spray and Plunge Bath.
ROSS, W., *Glasgow*, for Improved Paragon Valve.
ANGELL, A. T., *London*, for Air-tight Man-hole Covers.
BINNIE, J., *Gartcosh, Glasgow*, for his exhibit of Salt-glazed Fire-clay Sewer-pipes.
DOULTON & Co., Lambeth, *London*, for Silicon Tread for Steps.
GANDY, M., *Liverpool*, for Cotton Machine Belting.
GANDY, M., *Liverpool*, for Steil's Fastener for Machine Belting.

CLASS III.—HEATING, LIGHTING, AND VENTILATING.

HYDES & WIGFULL, *Sheffield*, for Tortoise Slow Combustion Stoves.
HYDES & WIGFULL, *Sheffield*, for Tortoise Laundry Stove.
CARRON Co., *Falkirk*, for Combined Close Fire and Gas Cooking Range.
MCGEOCH, W., & Co., *Glasgow*, for Dows' Close and Open Fire Cooking Range.
WALKER, TURNBULL & Co., *Falkirk*, for the Simplex Cooking Range.
HENDERSON, OSBERT, *Glasgow*, for the Albo-Carbon Light.
COOPER, H. W., & Co., *London*, for Glass Revolving and Sliding Ventilators.
ELLISON, J. E., *Leeds*, for "Radiator" Ventilator, with Screw Action.
HILL & HEY, *Halifax*, for Double Current Ventilators.
KITE, C., & Co., *London*, for Noiseless Chimney Breast Outlet Ventilator.

KITE, C., & Co., *London*, for Wall Inlet Ventilator.
LEGGOTT, W. & R., *Bradford*, for Opener for Fanlight.

CLASS IV.—PERSONAL HYGIENE, FOODS, FILTERS, AND DISINFECTANTS.

BILLINGTON BROS., *Liverpool*, for Spring Mattresses.
CHORLTON & DUGDALE, *Manchester*, for "Excelsior" Ships' Berth.
GARDNER, A., & SON, *Glasgow*, for Spring Mattress.
GARDNER, A., & SON, *Glasgow*, for Parquet Flooring.
GROVES, E. K., *Bristol*, for Self-acting Sick Bed.
GROSVENOR, F., *Glasgow*, for Stoneware Churns.
HENDERSON, OSBERT, *Glasgow*, for Pendulous Food-warmers.
VERNON'S PATENT CHINA AND GLASS COMPANY, *London*, for "Noiseless Ware."
JEYES' SANITARY COMPOUND Co., *London and Glasgow*, for Jeyes' Disinfecting Fluid.

CLASS V.—ARTICLES OF SANITARY INTEREST NOT INCLUDED IN THE ABOVE CLASSES.

HILLIARD, W. B., & SONS, *Glasgow*, for Isolating Curtain.
HILLIARD, W. B., & SONS, *Glasgow*, for Burn and Wound Boxes.
DURAND CLAYE, A., *Paris*, for his exhibit of Drawings and Books Relating to Disposal of Sewage in Paris.
SMITH, ELDER & Co., *London*, for Sanitary Publications.

We would explain that no awards have been made for cowls or similar ventilators, as a committee especially appointed by the Sanitary Institute, to carry out experiments on cowls, have not yet completed their investigations. It was mentioned in a recent report of the Council that this committee had found that the indications of the ordinary air meters which are used for testing cowls are unreliable. No definite conclusions can therefore be hoped for with reference to the comparison of cowls, until more accurate means of measurement have been arrived at. The committee are now directing their attention to this object.

Objects exhibited or invented by any of the judges are excluded from awards of medals or certificates.

EXHIBITS SELECTED FOR FURTHER PRACTICAL TRIAL.

With regard to the following Exhibits we are unable to give our decisions until we have submitted them to a more complete and extended practical examination than is possible at the Exhibition :—

CLASS I.—CONSTRUCTION AND MACHINERY.

WOOLLAMS, W., & Co., *London*, Pigments and Paper Hangings.
BOROUGH LEATHER WAREHOUSE COMPANY, *London*, Crocodile Hide Leather.
GARDNER, A., & SON., *Glasgow*, Preserved Timber.
ANDREW & Co., *Stockport*, Bischop's Gas Engine.
CROSSLEY BROS., *Manchester*, Otto Silent Gas Engine.
HILDESHEIM, J., *Glasgow*, Dicks' L'Extincteur.
FOTHERINGHAM, D., *Glasgow*, Fire Extinguisher.
MILLER, W., *Glasgow*, Extincteur.

CLASS II.—SEWERAGE AND WATER SUPPLY.

SHANKS & Co., *Glasgow*, Waste-preventing Cistern.
BOULNOIS, H. P., *Portsmouth*, Acme Sewer Pipes.
HARRISSON, T. HARNETT, *Liverpool*, Improved Collar-joint.
DOULTON & Co., *Lambeth, London*, Burning Brass to Lead.
ANGELL, A. T., *London*, Lip Siphon Trap.
EMPTAGE, D., *Margate*, Round Pipe Traps.

CLASS III.—HEATING, COOKING LIGHTING, AND VENTILATION.

ADAM'S GAS HEATING & STOVE Co., *Glasgow*, Gas Heating Stove.
BACON, J., L., & Co., *London*, Hot Water Apparatus.
CARRICK, J., *Glasgow*, Ventilating Open Fire Grate.
HENDERSON, OSBERT, *Glasgow*, Gas Stoves.
SHAW, A., & SON, *Glasgow*, "Verity's" Asbestos Gas Fire.
SINCLAIR, G., *Leith*, Mechanical Stoker.
ADAM'S GAS HEATING & STOVE Co., *Glasgow*, Gas Cooking Stove.
HENDERSON, O., *Glasgow*, "Eureka" Gas Cooking Stove.
SYDNEY, E., *London*, Working Man's Gas Cooker.
WADDELL & MAIN, *Glasgow*, Universal Domestic Cooking Stove.
WRIGHT & Co., *Birmingham*, "Eureka" Gas Cooker.
MILLER, R. *Glasgow*, Peebles Gas Governor.

CLASS IV.—PERSONAL HYGIENE, FOODS, FILTERS, AND DISINFECTANTS.

BRADBURY & Co., *Oldham*, Sewing Machines.
SINGER SEWING MACHINE Co., *Glasgow*, Sewing Machines.
DOULTON & Co., Lambeth, *London*, Filters of Manganous Carbon.
GROSVENOR, F., *Glasgow*, Filters.
HENDERSON, O., *Glasgow*, Silicated Carbon Filters.
MAIGNEN, P. A., *London*, Anti-Calcareous Powders.
BEVERIDGE & Co., *Glasgow*, Pickles, Sauces, and Essence of Coffee.
CONDENSED MILK Co., *Limerick*, Condensed Milk.
IRVINE & Co., *Gateshead-on-Tyne*, Mustard.
INDIAN TEA Co., *Glasgow*, Indian Tea.
SCOTT, A., & Co., *Glasgow*, Oat-flour.
CALVERT, F. C., & Co., *Manchester*, Sulpho-Carbolates.
CALVERT, F. C. & Co., *Manchester*, 50% Carbolic Disinfecting Powder.
OVERBECK, H. E., & Co., *Liverpool*, Pyridine Disinfecting Powder.
RIMMEL, EUGENE, *London*, Aromatic Ozonizer.
SARACEN SOAP Co., *Glasgow*, Sanitary Soap.
STANFORD, E. C. C., *Dalmuir*, Seaweed Charcoal.
WHEELER, J., *Ilfracombe*, Pixene.

No Award can be made of the Richardson Gold Medal, or of the Silver Medals offered by the Exeter Gas Company, until the deferred trials have taken place.

W. H. CORFIELD, M.A., M.D., Oxon., *Chairman.*
F. S. B. F. DE CHAUMONT, M.D., F.R.S.
W. EASSIE, C.E., F.G.S., F.L.S.
ROGERS FIELD, B.A., M.Inst.C.E.
H. LAW, M.Inst.C.E.
J. W. PEGGS, Assoc.M.Inst.C.E.
H. SAXON SNELL, F.R.I.B.A.
ERNEST TURNER, F.R.I.B.A.

APPENDIX.

EXAMINATIONS IN SANITARY SCIENCE FOR LOCAL SURVEYORS AND INSPECTORS OF NUISANCES.

BOARD OF EXAMINERS.

Chairman.

CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S.

H. C. BARTLETT, PH.D., F.C.S.
PROF. W. H. CORFIELD, M.A. LOND., M.D. OXON.
PROF. F. S. B. F. DE CHAUMONT, M.D., F.R.S.
ROGERS FIELD, B.A., M.INST. C.E.
W. H. MICHAEL, Q.C., F.C.S.
PROF. H. ROBINSON, M.INST. C.E.
M. OGLE TARBOTTON, M.INST. C.E., F.G.S.
ERNEST TURNER, F.R.I.B.A.

Registrar.

G. J. SYMONS, F.R.S.

THE great and increasing importance of the duties devolving upon Local Surveyors and Inspectors of Nuisances in connection with the various Acts relating to Public Health, the Sale of Food and Drugs Act, &c., has led the Council of the Sanitary Institute of Great Britain to establish Voluntary Examinations, to appoint a Board of Examiners, and to grant Certificates of Competency to Local Surveyors and Inspectors of Nuisances.

Visitors duly appointed by the Local Government Board and various bodies connected with the practical application of sanitary science are invited to be present at the Examinations.

The Examinations, which are arranged in two grades, are intended to enable Local Surveyors and Inspectors of Nuisances, or persons desirous of becoming such, or of obtaining the Certificate of the Institute, to prove their competency in the subjects of Examination. Successful Candidates will be placed on the Register of persons so certificated; this Register will be kept at the Offices of the Institute, and a copy will be forwarded to Local Boards and Sanitary Authorities on application.

Each Examination occupies a portion of two days. On the first day the Examination of Surveyors occupies four hours—viz., from 2 till 4, and from 6 till 8 p.m., and consists of written papers only. Inspectors of Nuisances have two hours' written examination on the first day—viz., from 4 till 6 p.m. On the second day the Examination, for both classes, commences at 11 a.m., and is *viva voce*,

with one or more questions to be answered in writing, *if deemed necessary*. A Certificate of competency, signed by the examiners, is granted to successful Candidates, entitling them to be designated as "Certificated by the Sanitary Institute of Great Britain."

As one person may, under the Public Health Act, 1875, be both Local Surveyor and Inspector of Nuisances, the Examinations are so arranged that Candidates who desire to do so, can enter for both Examinations on the same occasion.

Candidates are required to furnish the Board of Examiners with satisfactory testimonials as to personal character, and to give two weeks' notice to the Registrar previous to presenting themselves for Examination, stating whether they wish to be examined as Surveyors, as Inspectors of Nuisances, or as both. The fee for Examination must be paid to the Secretary, by Post-Office order or otherwise, at least six days before the day of Examination. On the receipt of the fee, a ticket will be forwarded admitting to the Examination.

The fees payable for the Examinations are as follows:—

For Surveyors	£5 5s.
For Inspectors of Nuisances . .	£2 2s.

Unsuccessful Candidates are allowed to present themselves a second time for one fee.

Examinations during the year are appointed to be held at the Rooms of the Institute:—

On Thursday and Friday, June 5th and 6th, 1884.
On Thursday and Friday, November 6th and 7th, 1884.

Forms to be filled up by Candidates previous to Examination will be supplied on application to the Secretary, 74A, Margaret Street, W.

SYLLABUS of SUBJECTS for EXAMINATION.

FOR LOCAL SURVEYORS.

LAWS AND BYE-LAWS—A thorough knowledge of the Acts affecting Sanitary Authorities, as far as they relate to the duties of Local Surveyors; also, of the Model Bye-Laws issued by the Local Government Board.

SEWERAGE AND DRAINAGE—The Sanitary principles which should be observed in the preparation of schemes for, and the construction of, Sewerage works; the ventilation and flushing of sewers and drains; the internal drainage and other Sanitary arrangements of houses, privies, water-closets, dry-closets, and the removal of refuse; the Sanitary details of Builders' and Plumbers' work.

WATER SUPPLY OF TOWNS AND HOUSES—The Sanitary principles which should be observed in the preparation of schemes for, and the construction of, Water-works; the various ways in which water is likely to become polluted, and the best means of ensuring its purity.

REGULATION OF CELLAR DWELLINGS AND LODGING HOUSES—General principles of Ventilation; the amount of air and space necessary for men and animals; the means of supplying air, and of ensuring its purity.

HIGHWAYS AND STREETS—The Sanitary principles which should be observed in the construction and cleansing of streets and roads.

All persons who have passed the above Examination and received the Certificate for Local Surveyors are, by virtue of having so passed, entitled to become Members of the Institute for Life, upon payment of Five Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

FOR INSPECTORS OF NUISANCES.

A thorough knowledge of the Provisions of the Acts and Model Bye-Laws relating to the duties of Inspector of Nuisances—also of the working of the Sale of Food and Drugs Act.

A fair knowledgde of the principles of Ventilation, and the simple methods of Ventilating Rooms—Measurement of Cubic Space.

A knowledge of the Physical Characteristics of Good Drinking Water—the various ways in which it may be polluted, and the means of preventing pollution—Methods of Water Supply.

A knowledge of the proper conditions of good drainage.

The advantages and disadvantages of various Sanitary Appliances for Houses—Inspection of Builders' and Plumbers' work.

A knowledge of what constitutes a Nuisance, arising from any Trade, Business, or Manufacture.

A fair knowledge of the characteristics of good and bad Food (such as Meat, Fish, Milk, Vegetables), so as to be able to recognise unsoundness.

Some knowledge of Infectious Diseases, and of the Regulations affecting persons suffering or recovering from such diseases.

A knowledge of the best Methods of Disinfection.

Methods of Inspection, not only of Dwellings, Dairies, and Milk-Shops, but of Markets, Slaughter-Houses, Cow-Sheds, and offensive Trades.

Scavenging and the Disposal of Refuse.

All persons who have passed the above Examination and received the Certificate for Inspectors of Nuisances are, by virtue of having so passed, entitled to become Associates of the Institute for Life, upon payment of Three Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

LIST OF BOOKS SUGGESTED BY THE EXAMINERS AS USEFUL TO CANDIDATES.

SURVEYORS.

Laws and Bye-Laws.

The principal Acts affecting Sanitary Authorities, viz:—

Gas Works Clauses Acts, 1847. *Price* 6*d.*
Water Works „ „ 1847. *Price* 1*s.*; & 1863, *price* 3*d.*
Public Health Act, 1875. *Price* 5*s.* 7½*d.*
„ „ Water, 1878. *Price* 4½*d.*
Rivers Pollution Act, 1876. *Price* 6*d.*
Artizans' and Labourers' Dwelling Acts, 1868. *Price* 7½*d.*; and 1875, *price* 1*s.*

} *Sold by Eyre & Spottiswoode.*

Local Government Board. Model Bye-Laws for Sanitary Authorities. *Eyre & Spottiswoode. Price* 4*s.* 6*d.*

†Chambers, George F. Digest of the Law relating to Public Health and Local Government. 7th Edition. *Stevens & Son. Price* £1 8*s.*

†Fitzgerald, Vesey. Public Health Act and Local Government Act, 1875. 3rd Edition. *Waterlow Bros. & Layton. Price* 12*s.* 6*d.*

†Glen, W.C., Q.C. Public Health Act. *Knight. Price* £1 16*s.*

†Lumley. Public Health Act, 1875. *Shaw & Son. Price* £1 5*s.*

†Michael & Will. On Gas and Water. *Butterworth. Price* £1 5*s.*

Stratton's Public Health Acts, 1875. 1880 Edition. *Knight. Price* 3*s.* 6*d.*

†Woolrych. On the Metropolis Local Management Acts. 2nd Edition. *Shaw & Son. Price* £1 1*s.*

†Smith, William Robert, M.D., and Smith, Henry, M.B. The Laws Concerning Public Health. *Sampson Low & Co. Price* £1 11*s.* 6*d.*

Sewerage and Drainage.

Boulnois, H. P., M.Inst.C.E. Dirty Dust-Bins and Sloppy Streets. *E. & F. N. Spon. Price* 3*s.* 6*d.*

Buchan, W. Paton. Plumbing. *Crosby, Lockwood & Co. Price* 3*s.* 6*d.*

Denton, J. Bailey, M.Inst.C.E. Sanitary Engineering. *E. & F. N. Spon. Price* £1 5*s.*

Field, Rogers, M.Inst.C.E. Bye-Laws and Regulations with reference to House Drainage. *E. & F. N. Spon. Price* 1*s.*

Fox, Cornelius B., M.D. Disposal of the Slop Water of Villages. *J. & A. Churchill. Price* 1*s.* 6*d.*

Galton, Douglas, C.B., F.R.S. Observations on the Construction of Healthy Dwellings. *Henry Frowde. Price* 10*s.* 6*d.*

Hellyer, S. S. The Plumber, and Sanitary Houses. 2nd Edition. *B. S. Batsford. Price* 10*s.* 6*d.*

KNIGHT & Co. Annotated Model Bye-Laws of the Local Government Board relating to—I. Cleansing of Privies, &c. II. Nuisances. III. New Buildings. *Knight & Co. Price* 8s. 6d.

LATHAM, BALDWIN, M.INST.C.E. Sanitary Engineering. *E. & F. N. Spon. Price* £1 10s.

RAWLINSON, ROBT., C.B. Suggestions as to Drainage, Sewerage, and Water Supply. *Knight. Price* 3s.

†Report of the Committee of The Local Government Board on Treatment of Town Sewage. *Hansard & Co. Price, Report* 1s.; *Plans* 10s.

RUSSELL, J. A. Two Lectures to Builders and Plumbers. *Simpkin, Marshall & Co.*, 1878. *Price* 1s. 6d.

ROBINSON, HENRY, C.E., F.G.S. Sewage Disposal. *E. & F. N. Spon. Price* 5s.

WATER SUPPLY OF TOWNS AND HOUSES.

†BUCHAN, A. Introductory Text Book of Meteorology. 2nd Edition. *W. Blackwood & Sons. Price* 4s. 6d.

†HUMBER, WILLIAM, ASSOC.M.INST.C.E. Water Supply of Cities and Towns. *Crosby, Lockwood & Co. Price* £6. 6s.

PARRY, JOSEPH, C.E. Water: its Composition, Collection, and Distribution. *F. Warne. Price* 2s. 6d.

†Sixth Report of the Royal Commissioners on Pollution of Rivers. *Hansard & Co. Price* 16s.

REGULATION OF CELLAR DWELLINGS AND LODGING HOUSES, VENTILATION, &C.

GALTON, DOUGLAS, C.B., F.R.S. Observations on the Construction of Healthy Dwellings. *Henry Frowde. Price* 10s. 6d.

HARTLEY, W. NOEL. Air and its Relation to Life. *Longmans, Green & Co. Price* 6s.

†PARKES, E. A., M.D., F.R.S., and F. DE CHAUMONT, M.D., F.R.S. A Manual of Practical Hygiene (Chapters on Air). *J. & A. Churchill. Price* 18s.

HIGHWAYS AND STREETS.

BOULNOIS, H. P., M.INST.C.E. Dirty Dust-Bins and Sloppy Streets. *E. & F. N. Spon. Price* 3s. 6d.

CODRINGTON, T., M.INST.C.E. Maintenance of Macadamised Roads. *E. & F. N. Spon. Price* 6s.

GENERAL.

†PARKES, E. A., M.D., F.R.S., and F. DE CHAUMONT, M.D., F.R.S. A Manual of Practical Hygiene. *J. & A. Churchill. Price* 18s.

†WILSON, G., M.A., M.D. Handbook of Hygiene and Sanitary Science. *J. & A. Churchill. Price* 10s. 6d.

†MURPHY, SHIRLEY F. Our Homes, and how to make them Healthy. *Cassell & Co. Price* 15s.

INSPECTORS OF NUISANCES.

The Principal Acts relating to the Duties of Inspectors, viz:—

Public Health Act, 1875. *Price* 5*s.* 7½*d.*
" " Water, 1878. *Price* 4½*d.*
Canal Boats Act, 1877. *Price* 3*d.*
Sale of Food and Drugs Acts, 1875. *Price* 6*d.*; and 1879, *price* 3*d.*
Rivers Pollution Act, 1876. *Price* 6*d.*
Artizans' and Labourers' Dwellings Acts, 1868. *Price* 7½*d.*; and 1875, *price* 1*s.*
Alkali, &c., Works Regulations Act, 1881. *Price* 5*d.*
Nuisances Removal Acts, 1855. *Price* 1*s.*; 1860, *price* 3*d.*; and 1866, *price* 1½*d.*

Sold by Eyre & Spottiswoode.

Local Government Board. Model Bye-Laws for Sanitary Authorities. *Eyre & Spottiswoode. Price* 4*s.* 6*d*

Local Government Board. General Orders relating to Duties of Inspectors of Nuisances, issued March 10th and 13th, 1880.

Metropolitan Board of Works. Bye-Laws under the Slaughter-houses, &c., Act; eight in number.

Metropolitan Board of Works. The Dairies Cowsheds, and Milkshops Order of July, 1879.

STRATTON'S Public Health Acts, 1875. 1880 Edition. *Knight. Price* 3*s.* 6*d.*

†WOOLRYCH. On the Metropolis Local Management Acts. 2nd Edition. *Shaw & Son. Price* £1. 1*s.*

BOULNOIS, H. P., M.INST.C.E. Dirty Dust-Bins and Sloppy Streets. *E. & F. N. Spon. Price* 3*s.* 6*d.*

CORFIELD, W. H.. M.A., M.D. The Laws of Health. *Longman & Co. Price* 1*s.* 6*d.*

CORFIELD, W. H., M.A., M.D. Dwelling Houses: their Sanitary Construction and Arrangements. *H. K. Lewis. Price* 3*s.* 6*d.*

F. DE CHAUMONT, F.S.B., M.D., F.R.S. Manuals of Health. The Habitation in Relation to Health. *Society for Promoting Christian Knowledge. Price* 1*s.*

FIELD, ROGERS, M.INST.C.E. Bye-Laws and Regulations with Reference to House Drainage. *E. & F. N. Spon. Price* 1*s.*

KNIGHT & Co. Annotated Model Bye-Laws of the Local Government Board relating to—I. Cleansing of Privies, &c. II. Nuisances. III. New Buildings. *Knight & Co. Price* 8s. 6d.

HARTLEY, W. NOEL. Water, Air, and Disinfectants. *Society for Promoting Christian Knowledge. Price* 1*s.*

†PARKES, E. A., M.D., F.R.S., and F. DE CHAUMONT, M.D., F.R.S. A Manual of Practical Hygiene. (Chapters on Water, Air, Food, and Sewage). *J. & A. Churchill. Price* 18*s.*

†MURPHY, SHIRLEY F. Our Homes, and how to make them Healthy. *Cassell & Co. Price* 15*s.*

† *Books marked thus are Works of Reference.*

It is not necessary that Candidates should study all the works mentioned in this List, as two or three are quoted in some subjects to afford greater facilities for obtaining the information.

CANDIDATES WHO HAVE RECEIVED CERTIFICATES AS LOCAL SURVEYORS.

1880, Nov. 5, Boulnois, H. Percy, M.Inst.C.E., Portsmouth.
1880, Nov. 5, Burton, W. Kinninmond, Adam Street, Adelphi.
1879, June 4, Cameron, Donald, Exeter.
1880, June 2, Clare, Jesse, Sleaford.
1882, Nov. 3, Cooper, C. H., Wimbledon.
1883, June 8, Comber, P. F., Bray, Ireland.
1878, June 5, Gamble, S. G., A.M.I.C.E., Grantham.
1881, June 3, Grimley, Samuel S., Ashby-de-la-Zouch.
1878, Nov. 7, Harger, R., Skipton.
1880, Nov. 5, Harland, A., A.R.I.B.A., Stanhope Street, N.W.
1882, June 9, Hubber, Frank, Exeter.
1880, Nov. 5, Innes, Cosmo, M.Inst.C.E., Adam Street, Adelphi.
1878, June 5, Jenkins, W. J. P., Bodmin.
1883, Nov. 2, Maguire, W. R., Dublin.
1883, June 8, Mawbey, E. G., King's Lynn.
1880, June 2, Nichols, H. B., Handsworth.
1877, Oct. 29, Parker, J., Mansion House, Hereford.
1877, Oct. 29, Robinson, H. W., Ulverston.
1879, June 4, Touzeau, E. M., Strand, W.C.
1881, June 3, Whitcombe, A., A.R.I.B.A., John St., Adelphi.
1882, June 9, Witts, J. W., Market Harborough.

CANDIDATES WHO HAVE RECEIVED CERTIFICATES AS INSPECTOR OF NUISANCES.

1882, June 9, Abrams, H., Bromley, Kent.
1882, June 9, Atkins, W., Kettering.
1882, June 9, Baxter, J., Walnut Tree Walk, S.E.
1877, Oct. 29, Blanchard, Thomas, Evesham.
1879, Nov. 7, Bolt, Benjamin, Aston, Birmingham.
1877, Oct. 29, Booker, F., St. Mary's Hall, Coventry.
1882, Nov. 3, Brown, John, Geneva Terrace, Brixton.
1878, Nov. 7, Chubb, T. T., Whitchurch.
1880, June 2, Clare, J., Sleaford.
1879, Nov. 7, Clarke, A. Lennox, Union Buildings, Selly Oak.
1881, June 3, Cowderoy, J. T., Wolverhampton.

1883. Nov. 2, CROGHAN, THOMAS ANDREW, Buxton.
1878, June 5, DALE, T. H., Town Hall, Hull.
1878, Nov. 7, DAVIES, H., Wrexham.
1883, June 8, DENT, W., Nelson, Lancashire.
1883, June 8, EDMONDSON, S., Walshaw, near Burnley.
1882, June 9, FAIRCHILD, S. G., Shorrold Road, Walham Green.
1882, June 9, FINLAY, A., Town Hall, Scarborough.
1878, Feb. 7, GANDER, C., Alcester.
1880, Nov. 5, HARLAND, A., Stanhope Street, N.W.
1878, Nov. 7, HARRIS, W., Solihull.
1878, June 5, HAWKES, C., Hackney
1883, June 8, HEARNE, W., Tavistock Street, W.C.
1881, Nov. 4, HORROCKS, J., Bolton.
1883, June 8, JOHNSON, G., Bedford.
1883, Nov. 2, JOYNER, W. J., Birmingham.
1883, Nov. 2, KEMSLEY, JESSE, Rodwell Road, Dulwich.
1879, Nov. 7, LAPWORTH, J., Bethnal Green.
1882, Nov. 3, LEGG, S. C., Gayhurst Road, E.
1882, June 9, LIGHTFOOT, T., Trevor Square, Knightsbridge.
1883, Nov. 2, MAGUIRE, J., Bolton.
1883, June 8, MERRIE, A. W., Bedford.
1879, Nov. 7, OSBORNE, J., Carlisle.
1877, Oct. 29, PREBBLE, W. S., Blackburn.
1881, June 3, RAINS, J., Kettering.
1882, Nov. 3, RICHARDS, DANIEL, Spencer Street, S.W.
1878, Feb. 7, ROBINSON, J., South Street, Park Lane.
1881, Nov. 4, SORTWELL, W., Retreat Place, Hackney.
1882, June 9, STEERS, G., Wellington Street, Bedford.
1882, Nov. 3, TAYLOR, ALBERT, Egremont, Cheshire.
1882, Nov. 3, WATSON, JAMES, Exeter.
1878, Feb. 7, WATTS, W. F., South Stoneham.
1883, June 8, WELLS, G. F., Hull.
1883, Nov. 2, WELLS, WILLIAM HENRY, Budleigh Salterton.
1878, Feb. 7, WETHERILL, W., Norfolk Street, Batley.
1878, Feb. 7, WILKINSON, W., Salford.
1881, June 3, WILKINSON, W., Bury, Lancashire.
1881, Nov. 4, WITTS, J. W., Market Harborough.
1882, June 9, WRIGHT, NOAH, Coventry.

EXAMINATION QUESTIONS, 1883.

The following questions were required to be answered in writing. A *viva voce* examination took place on the following day.

JUNE 7th, 1883.

SURVEYORS—PAPER I. 2 TO 4 P.M.

1.—What are the main provisions of the Rivers Pollution Act?

2.—Give the substance of the Model Bye-laws for Regulating—

(*a*) Cleansing of Footways and Pavements.
(*b*) Removal of House Refuse.
(*c*) Cleansing of Earth Closets, Privies, Ashpits and Cesspools.

3.—Why ought sewers to be ventilated? What circumstances favour the formation of foul gases in sewers? and how can new sewers be constructed so as to prevent or greatly reduce the formation of such gases?

4.—What is meant by disconnecting a house drain from the sewer? Describe what adjuncts are necessary and what arrangements should be made for ventilation. Give a sketch of any two disconnecting arrangements.

5.—Describe the arrangements you would adopt in a town situated on the side of a hill to prevent the lower districts being flooded, or the upper districts being injured by foul gases from the sewers.

6.—Explain the following processes for purifying sewage, and describe the mode of action in each case—

(*a*) The Lime and one other precipitation process.
(*b*) The Irrigation of land.

How would you lay out the land for a Sewage Farm, selecting your own conditions of situation and soil?

SURVEYORS—PAPER II. 6 TO 8 P.M.

1.—Explain what is meant by "Constant" and by "Intermittent" Water Supply. What are the advantages and disadvantages of each? What precautions are necessary in each case to prevent the water becoming polluted inside a house—

(*a*) With cisterns,
(*b*) Without cisterns?

2.—Mention the quantity of water supplied per head per diem in any four large towns in England. How much of this has probably been used for domestic purposes, how much for town and manufacturing purposes, and how much has run to waste? How is the amount of waste ascertained and remedied?

3.—Give a description and sketch of an ordinary Rain Gauge. Mention the points to be observed in fixing it, in order to obtain a correct record of the amount of rainfall. Is it a good plan to place a Rain Gauge on the top of a house or of a wall? State the reasons for your opinion. What is the annual amount of rainfall in some of the localities with which you are acquainted?

4.—Describe systems of ventilation that you would consider efficient for—

(*a*) A Church.
(*b*) A Dwelling House.

5.—Give the definition of a Cellar Dwelling. Under what conditions does the Act allow it to be occupied? State the most common causes of dampness in basement rooms, and what remedies you would suggest in each case.

6.—Describe the various methods of laying wood pavement. Give an explanatory sketch, and state the advantages of and objections to wood pavement.

INSPECTORS OF NUISANCES—4 TO 6 P.M.

1.—State the provisions of the Law with reference to Common Lodging Houses.

2.—How does the Public Health Act define a nuisance? If you find a nuisance to exist on any premises, what steps would you take?

3.—How much cubic space would you recommend per person in a sleeping room?

4.—Describe a simple but efficient plan of ventilation for a cottage of four rooms.

5.—What steps would you take if a well in a village were reported to be polluted? How may water be polluted within a dwelling?

6.—What are the objections which are inseparable from Cesspools?

7.—How can the access of sewer air to houses be prevented?

8.—In what way would you proceed to disinfect clothing after a case of infectious disease? What powers have you to disinfect rooms? Describe the methods that you would adopt.

NOVEMBER 1st, 1883.

LOCAL SURVEYORS—PAPER I. 2 TO 4 P.M.

1.—What are the principal Sanitary Acts in force—

(*a*) In the Metropolis?
(*b*) In other parts of England?

What are their chief provisions?

2.—State the chief differences which exist between the powers exercised by Urban and by Rural Sanitary Authorities—

(*a*) As to roads, streets and buildings.
(*b*) As to sewers.
(*c*) As to gas and water supply.

3.—In what way does the size and shape of a sewer affect the velocity of the sewage flowing through it? If a 12-inch pipe sewer with an inclination of 1 in 200 gives a velocity of $3\frac{1}{2}$ feet per second, what velocity would it give if laid at an inclination of 1 in 800 (the pipe running half full in each case)? Would this latter velocity suffice to keep the sewer self-cleansing? To what extent could this velocity be practically increased by flushing?

4.—A complaint being made that an offensive smell proceeds from a certain sewer, what steps should be taken (*a*) to find out the cause? (*b*) to remedy the same? Illustrate your answer by a sketch.

5.—What precautions should be taken in connecting house drains with sewers in order to prevent foul air from the sewers entering the houses? What kind of connections would you require for the water-closets, sinks, &c.

6.—Describe shortly the different methods of applying sewage to land, and in each case explain the conditions under which you would adopt it.

LOCAL SURVEYORS—PAPER II. 6 TO 8 P.M.

1.—What is meant by a "gathering ground"? Describe the conditions which have to be observed in selecting a gathering ground for the water supply of a town. Upon what data would you base your calculations for providing a sufficient supply in all seasons?

2.—The water supply of a town being undesirably hard, what means would you recommend for softening the same? Describe generally the principles involved.

3.—State the geological formations which yield hard water and those which yield soft water. State also the chief difference between river water and water derived from shallow and from deep wells.

4.—What is required in the way of ventilation to keep a room containing 1,000 cubic feet of air space, and occupied by one person, in a proper sanitary condition, there being a gas light burning in the room 6-ft. from the floor, consuming 4-ft. of gas per hour? State the amount of deterioration of the air due to the man and to the gas light respectively. Illustrate your answer by a sketch.

5.—What are the sanitary advantages and disadvantages of the modern systems of street and road making? Give a brief description of each.

6.—Describe the best methods for cleansing streets.

INSPECTORS OF NUISANCES.—4 TO 6 P.M.

1.—Describe some of the main provisions of the Public Health Act, 1875, with reference to the duties of an Inspector of Nuisances.

2.—On being appointed to the post of Inspector of Nuisances of a district, what are the duties you would at once undertake—

(*a*) With regard to Inspection of Common Lodging Houses?
(*b*) With regard to Nuisances?
(*c*) With respect to the Wholesomeness of Food?

3.—Describe the method of measuring available air space in rooms. How much air space per head is desirable? How much should be insisted on?

4.—What is the object of ventilation? Describe some simple methods of ventilation which you would recommend for living and for sleeping rooms?

5.—What precautions ought to be taken in obtaining water supply from wells in the proximity of dwellings?

6.—What precautions have to be observed to prevent the pollution of a milk supply at farms and cow-sheds?

7.—If there is reason to suspect that sewer gas is escaping into houses, in what way would you proceed to examine the drains? And what points would you look to? Write a report on a supposed case such as you would send in to your Medical Officer.

8.—You are sent for to a house where two children died the day previously of scarlet fever, what steps would you take?

EXHIBITIONS OF SANITARY APPARATUS AND APPLIANCES.

THE Exhibitions of Sanitary Appliances are held annually in connection with the Autumn Congress, and unpatented exhibits are protected by a certificate granted by the Board of Trade, under the Protection of Inventions Act, 1878.

Judges are appointed by the Council to examine the several exhibits, and award Medals and Certificates of Merit to such objects as they may consider worthy.

In addition to the Ordinary Medals, a special Medal — the Richardson Medal—is offered by the Institute, for a selected exhibit from the entire exhibition, and will be awarded by the Judges in cases of pre-eminent merit only. Selected exhibits of such a nature as to require practical trials which cannot be carried out on the spot, are submitted to such trials upon the Exhibitors defraying the necessary expenses.

The Exhibits are arranged in the following Classes :—

CLASS I.—CONSTRUCTION AND MACHINERY.

- Construction and Materials.
- Paints and other Protectives.
- Wall Papers.
- Decorative Materials.
- Machinery adapted for Sanitary Purposes.
- Washing Machines.

CLASS II.—SEWERAGE AND WATER SUPPLY.

- Water Closets.
- Dry Closets.
- Urinals.
- Sewage Treatment.
- Traps.
- Sinks.
- Baths and Lavatories.
- Apparatus for Water Supply.
- Cisterns.
- Flushing and Watering.
- Miscellaneous Sanitary Goods.

CLASS III.— HEATING, LIGHTING, AND VENTILATION.

- Heating Apparatus.
- Cooking Apparatus.
- Smoke Preventing Appliances.
- Lighting, including Electric Lighting.
- Ventilation.

CLASS IV.— PERSONAL HYGIENE, FOODS AND DISINFECTANTS.

- Clothing.
- Beds, &c.
- Educational Appliances.
- Domestic Appliances.
- Foods.
- Filters, and Arrangements for Softening Water.
- Mineral Waters.
- Disinfectants.
- Disinfecting Apparatus.

CLASS V.—MISCELLANEOUS.

Articles of Sanitary interest not included in the above Classes, such as :—

- Scientific Instruments.
- Books on Sanitation.
- Prevention of Accidents.
- Methods for the Disposal of the Dead, &c., &c., &c.

The following were the Regulations made for the Exhibition at Glasgow, in September, 1883 :—

1.—The Scale of Charge for Floor Space will be 12s. 6d. per foot frontage, with a depth of six feet; Corners and Special Places will be charged at higher rates; Wall Space 6d. to 1s. per square foot. No Floor Space will be allotted for a less sum than £1 5s., or Wall Space for less than 5s. All charges must be paid at the time of Allotment.

2.—Applications for Space must be made on the official form, and under the proper class. They must be sent to Mr. E. L. Box, the Curator of the Exhibition, at the Offices of the Institute, 9, Conduit Street, Regent Street, London, W., not later than Saturday, August 25th, 1883. No application after this date will be received unless accompanied by an extra payment of 5s. per foot frontage.

3.—A full and accurate description of the articles proposed to be shown must be forwarded with each application for space. (*See* No. 12.)

4.—In addition to Articles and Inventions of a strictly technical character, articles of a general character relating to domestic comfort and economy, and life and labour-saving apparatus, as well as books, drawings, and photographs, illustrative of the same, may be exhibited.

5.—Exhibits will be received at the Exhibition Building, Glasgow, from Tuesday, September 11th, to Tuesday, September 18th. Exhibits arriving after September 18th will only be admitted on payment of a fine of 5s. per foot frontage; but no Exhibit will, under any circumstances, be admitted after Friday, September 21st. No Exhibits shall be removed before MONDAY, the 22nd of OCTOBER, and all exhibits must be removed by WEDNESDAY, the 24th of OCTOBER, or they will be sold to pay expenses.

6.—The position occupied by each Exhibit will be determined by the Committee.

7.—Every Article exhibited shall bear a descriptive label, corresponding with the description forwarded with the application (*See* No. 3), and giving also the retail price at which the article can be obtained. The objects exhibited shall be either the actual Articles, Models, or Drawings.

8.—The Exhibition Committee reserve the right to refuse, or order the removal of, any article not deemed suitable.

9.—The Committee will not be responsible for insurance against fire, or in any way for the safety of any articles exhibited. The cost of conveying goods into, placing them in position in, and removing them from, the the Exhibition, including unpacking and packing, must be borne by the Exhibitors.

10.—Under the supervision and control of the Curator, Exhibitors will be permitted to erect benches or other contrivances for displaying their Exhibits, and to make connections with the main drain, but will be responsible for the removal of their Exhibits and Fittings at the close of the Exhibition, and must make good, to the satisfaction of the Master of Works, any damage caused thereby. Gas and Water will be supplied to the Exhibitors, for use in connection with their Exhibits, and charged for.

11.—Exhibitors are permitted to employ persons to explain their Exhibits, and such persons may receive orders, but are prohibited from soliciting them.

12.—A Catalogue will be published under the authority of the Committee, mainly compiled from the information given by the Exhibitors on their application forms. A few pages in the Catalogue will be reserved for approved Advertisements. For Terms for Advertisements apply to J. MASON, 144, Fleet Street, London, E.C. Advertisements to be forwarded not later than SATURDAY, 8th SEPTEMBER, 1883.

13.—PRIZE MEDALS and CERTIFICATES OF MERIT will be awarded at the discretion of the Judges, and their decisions will in all cases be final. The List of Awards will be published in the Transactions of the Institute for 1883.

13*a*.—The Council appoint Judges whose office is purely honorary, in accordance with Bye Law 128, which prohibits the payment of any remuneration whatever for such services.

14.—It may be impossible for the Judges to come to a satisfactory decision as to the merits of certain Exhibits without practical trial, involving special testing and other investigations. In all such cases the following regulations will be adopted:—

(*a*) The Judges have power to take from the Exhibition any specimens they may require for testing.

(*b*) The Judges will select such Exhibits for further practical trial as they may deem desirable. Exhibitors of such selected Exhibits will then be communicated with, and if they desire to submit their Exhibits to a deferred practical trial they will be required to pay such an Entrance Fee as the Committee may determine, for the purpose of defraying the necessary expenses of testing the Exhibits; and also to furnish the Committee with a written or printed statement of the grounds upon which they claim special merit for their Exhibits; and in the case of Patented Inventions, a copy of the Printed Specification of the Patent.

15.—THE RICHARDSON MEDAL *for an* EXHIBIT SELECTED FROM THE ENTIRE EXHIBITION *will be awarded by the Judges in case of pre-eminent merit only.*

16.—SILVER MEDALS OFFERED BY THE EXETER GAS COMPANY.—Three Silver Medals are offered by the Exeter Gas Company for the best Gas Stoves exhibited under the following classes:—

1. For the best Gas Stove or Gas Apparatus for cooking purposes for families, including a sufficient supply of hot water.
2. For the best Gas Cooking Stove for an artisan's family of from four to eight persons.
3. For the best and most economical Open Gas Fire.

17.—Protection in accordance with the Protection of Inventions Act, 1870, will be obtained from the Board of Trade for persons desirous of Exhibiting New Inventions.

Table giving particulars with reference to the exhibitions already held.

	1877. Leamington.	1878. Stafford.	1879. Croydon.	1880. Exeter.	1882. Newcastle.	1883. Glasgow.
Number of Exhibitors	117	116	189	106	110	126
Number of Exhibits	294	319	710	500	600	750
Space occupied (in square ft.)	.....	.....	.....	9725	14520	20,000
Number of days Exhibition was open	14	16	17	19	25	25
Total number of Visitors	.....	.....	.....	8955	8373	20,000
Number of Medals awarded	13	13	12	12	15	18*
Number of Special Certificates	None.	6	9	7	4	12
Number of Certificates	None.	. 21	38	40	72	46*
Number of Exhibits deferred for further trial	.....	7	52	30	37	44

* These numbers do not include any Medals or Certificates which may be awarded for Exhibits deferred for practical trial.

CLASSIFIED LIST OF MEDALS AWARDED AT THE EXHIBITIONS.

RICHARDSON MEDAL.

Siemens's Regenerative Gas Burner. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Griffiths' Patent White. Silicate Paint Company, *Cannon Street, E.C.* STAFFORD, 1878.

SILVER MEDAL.

Offered by the Exeter Gas Company.

Dr. Bond's Euthermic Ventilating Gas Stove. Sanitary & Economic Supply Association, *Gloucester.* EXETER, 1880.

MEDALS AND SPECIAL CERTIFICATES.

Exhibits which have already received Medals at previous Exhibitions of the Institute are excluded from awards of Medals; but those Exhibits to which a second Medal would otherwise be awarded receive Special Certificates, and these are distinguished in the following list by asterisks.

CLASS I.—CONSTRUCTION AND MACHINERY.

(1). Construction and Materials.

Aluminium Crown Metal. Aluminium Crown Metal Co., *Glasgow.* GLASGOW, 1883.

Delta Metal. Alex. Dick, *London.* GLASGOW, 1883.

*Improvements in Hollow Tile Flooring. G. E. Pritchett, F.S.A., 20, *Spring Gardens, S.W.* CROYDON, 1879.

Damp-proof Concrete Pavement. W. B. Wilkinson, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Silica Glazed and Enamelled Fire Clay Bricks and Fäience. Willcocks & Co., *Burmantofts, Leeds.* CROYDON, 1879.

(2). Paints and other Protectives.

Scottish Asbestos. Scottish Asbestos Co., *Glasgow.* GLASGOW, 1883.
Griffiths' Patent White, and for their preparations of Silicate Paint, Enamel Paint, and Petrifying Liquid. Silicate Paint Company, *Cannon Street, E.C.* STAFFORD, 1878.
Leadless "Charlton White" Paint and Dryers. J. B. Orr & Co., *Charlton, London.* GLASGOW, 1883.

(3). Wall Papers.

Paper Hangings free from Arsenic. Woollams & Co., *High Street, Marylebone, London.* CROYDON, 1879.
*Non-arsenical Wall Papers. Woollams & Co , *London.* NEWCASTLE, 1882.

(4). Decorative Materials.

Colouring Patterns through the Substance of Wood. H.Chalk Webb, *Worcester.* EXETER, 1880.
Wedgwood Ornamental Tiles. W. B. Morrison, *Glasgow.* GLASGOW, 1883.

(5.) Machinery adapted for Sanitary Purposes.

Improved Six-Ton Steam Road Roller. Aveling & Porter, *Rochester,* CROYDON, 1879.
Fryer's Destructor, Fryer's Carbonizer, and Firman's Dessicating and Rendering Apparatus. Manlove, Alliott, Fryer & Co., *Nottingham.* NEWCASTLE, 1882.

(6). Washing Machines.

Improved Washer, with table complete. J. Borwell, *Britannia Foundry, Burton-on-Trent.* LEAMINGTON, 1877.
New "Shuttle" Steam Power Washing Machine. T. Bradford & Co., *London and Manchester.* LEAMINGTON, 1877.
*Shuttle Steam-Power Washing Machine. Thomas Bradford & Co., *London and Manchester.* STAFFORD, 1878.
Washing Machines. Thomas Bradford & Co., *London and Manchester.* NEWCASTLE, 1882.
*Washing Machines. Thomas Bradford & Co., *London and Manchester.* GLASGOW, 1883.

CLASS II.—SEWERAGE AND WATER SUPPLY.

(1). Water Closets.

Excelsior Water Closet. D. T. Bostel, *Duke Street, Brighton.* LEAMINGTON, 1877.
*"Excelsior" Water Closet. D. T. Bostel, *Duke Street, Brighton.* STAFFORD, 1878.
Full-flush Valveless Closet. Hayward, Tyler & Co., *London.* NEWCASTLE, 1882.
Household Water Closet. O. D. Ward, *London.* NEWCASTLE, 1882.

(2). Dry Closets.

Dry Earth Closets. British Sanitary Company, *Glasgow.* NEWCASTLE, 1882.

*Improved Self-acting Earth Closets. British Sanitary Co., *Glasgow.* GLASGOW, 1883.

Excreta Pail (oak) with Spring Lid. B. B. Haresceugh & Co., *Bentinck Street, Leeds.* LEAMINGTON, 1877.

*Excreta Pail (oak) with Spring Lid. B. B. Haresceugh & Co., *Leeds.* STAFFORD, 1878.

Dry Earth or Ashes Closet. R. R. Heap, *Manchester.* GLASGOW, 1883.

Dry Closet, suitable for Ashes or Disinfecting Powder. L. Moser, *Southampton.* EXETER, 1880.

Earth Closets. Moule's Patent Earth Closet Company, 5*a*, *Garrick Street, W.C.* STAFFORD, 1878.

*Earth Closet. Moule's Patent Earth Closet Company (Limited), 5*a*, *Garrick Street, W.C.* CROYDON, 1879.

Dry Earth Closet. J. Parker, *Woodstock, Oxford.* LEAMINGTON, 1877.

Portable Cinder Sifting Ash Closet, with Soil Pail. Sanitary Appliance Company, *Salford.* STAFFORD, 1878.

*Cinder-Sifting Ash Closet. Sanitary Appliance Company, *Factory Lane, Salford.* CROYDON, 1879.

*Moule's Earth Closet. Wippell Bros. & Bow, 231 and 232, *High Street, Exeter.* EXETER, 1880.

(3). Urinals.

(4). Sewage Treatment.

No awards.

(5). Traps.

Exhibit of Stoneware Disconnecting Traps. J. Stewart, Sen., *Glasgow.* GLASGOW, 1883.

(6). Sinks.

No awards.

(7). Baths and Lavatories.

Hot-Air Bath. T. Galbraith, *Crawford Square, Londonderry.* LEAMINGTON, 1877.

Concrete Bath in one piece. W. H. Lascelles, *Bunhill Row, E.C.* CROYDON, 1879.

*Concrete Bath, in one piece. W. H. Lascelles, *Bunhill Row, E.C.* EXETER, 1880.

Porcelain Bath. Joseph Cliff & Sons, *Leeds.* GLASGOW, 1883.

Fire-Clay Enamelled Bath. John Hall & Co., *Stourbridge.* GLASGOW, 1883.

Flushing Rim Lavatory Basin and Apparatus. Tylor & Sons, *Newgate Street, E.C.* EXETER, 1880.

(8). Apparatus for Water Supply.

Anti-Percussion High Pressure Valves. Doulton & Co., *Lambeth, London.* CROYDON, 1879.

*Anti-percussion High Pressure Draw-off Valves. Doulton & Co., *Lambeth, London.* EXETER, 1880.

*Anti-percussion High-pressure Valves Doulton & Co., *Lambeth. London.* GLASGOW, 1883.

Anti-percussion Ball Valve. Doulton & Co., *London.* NEWCASTLE, 1882.

Improvements in Well Sinking Apparatus. Le Grand & Sutcliffe, *Bunhill Row, E.C.* LEAMINGTON, 1877.

Buck's Automatic Rain-water Separator. Charles G. Roberts, *Haslemere, Surrey.* NEWCASTLE, 1882.

*Buck's Automatic Rain-water Separator. C. G. Roberts, *Haslemere, Surrey.* GLASGOW, 1883.

*Improvements in Internal driving of Tube Wells. Le Grand & Sutcliffe, 100, *Bunhill Row, London.* CROYDON, 1879.

(9). Cisterns.

(10). Flushing and Watering.

No awards.

(11). Miscellaneous Sanitary Goods.

Exhibit of Sanitary Appliances. W. P. Buchan, *Glasgow.* GLASGOW, 1883.

Direct Acting Valveless Waste Preventer. A. T. Bean, 5, *Cannon Row, S.W.* EXETER, 1880.

Stanford's Joints for Stoneware Pipes. Doulton & Co., *Lambeth, London.* STAFFORD, 1878.

*Stanford's Joints for Stoneware Pipes. Doulton & Co., *Lambeth, London.* EXETER, 1880.

*Stoneware Pipes with Stanford's Joint. J. Stewart, Sen., *Glasgow.* GLASGOW, 1883.

*Bean's Direct Acting Valveless Waste Preventer. O. D. Ward, *London.* NEWCASTLE, 1882.

CLASS III.—HEATING, LIGHTING, AND VENTILATION.

(1). Heating Apparatus.

Ventilating Tile Stove. Doulton & Co., *Lambeth, London.* EXETER, 1880.

*Ventilating Tile Stoves. Doulton & Co., *London.* NEWCASTLE, 1882.

*Ventilating Tile Stove. Doulton & Co., *Lambeth, London.* GLASGOW, 1883.

Challenge Hot-water Boiler. J. Keith, *London and Edinburgh.* GLASGOW, 1883.

Silicate Cotton (Slag-wool). J. A. G. Ross, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Dr. Bond's Euthermic Gas Stove. Sanitary & Economic Supply Association, *Gloucester.* EXETER, 1880.

(2). Cooking Apparatus.

Apparatus for Cooking by Gas. Billing & Co., *Hatton Garden, E.C.* STAFFORD, 1878.

*"Workman's" Cooking Stove, and other Improvements in Gas-Cooking Stoves. Billing & Co., *Hatton Garden, E.C.* CROYDON, 1879.

Economical Cooking Range. G. H. Harris, *Bristol Street, Birmingham.* LEAMINGTON, 1877.

*Economical Cooking Range. G. H. Harris, *Bristol Street, Birmingham.* STAFFORD, 1878.

Phœnix Portable Range, and the Birmingham Range with Reducible Fire without Gas. Hassall & Singleton, *Birmingham.* STAFFORD, 1878.

Apparatus for Cooking by Gas. S. Leoni & Co., *Strand.* STAFFORD, 1878.

"Sine quâ non" Open and Close Fire Range. A. Shaw & Son, *Glasgow.* GLASGOW, 1883.

Artizan Cooking Range. Walker, Turnbull & Co., *Falkirk.* GLASGOW, 1883.

Improved Open or Close Range Kitchener. W. P. Wenham, *Church Street, Croydon.* CROYDON, 1879.

Wilson Portable Close Cooking Range. Wilson Engineering Company, *Holborn, W.C.* EXETER, 1880.

Improved Wilson Range with Steel Boiler and non-conducting Jacketting. Wilson Engineering Company, *London.* NEWCASTLE, 1882.

*"Wilson Cooking Range." Wilson Engineering Company, *London,* GLASGOW, 1883.

Cooking Range with Revolving Fire for the Prevention of Smoke. Whyte & Bradford, *Bowness.* GLASGOW, 1883.

(3). Lighting.

Prismoidal Pavement and Floor Lights. Hamilton & Co., *Leadenhall Street, E.C.* CROYDON, 1879.

Siemens's Regenerative Gas Burner. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Mercury Gas Governor. James Stott & Co., *Oldham.* NEWCASTLE, 1882.

*"Stott" Gas Governor. A. Brown & Co., *Glasgow.* GLASGOW, 1883.

(4). Ventilation.

Conical Ventilators. J. E. Ellison, *Leeds.* STAFFORD, 1878.

*Conical Ventilators. J. E. Ellison, *Leeds.* CROYDON, 1879.

*Conical Ventilators. J. E. Ellison *Leeds.* GLASGOW, 1883.

Auto-Pneumatic Ventilation. Nathan Hunt, *Bristol.* EXETER, 1880.
Glass Louvre Ventilators. J. Moore, *St. James' Walk, Clerkenwell, E.C.* EXETER, 1880.
Economic Hollow Flooring. G. E. Pritchett, 20, *Spring Gardens, S.W.* STAFFORD, 1878.

CLASS IV. — PERSONAL HYGIENE FOODS, AND DISINFECTANTS.

(1). Clothing.

No awards.

(2). Beds, &c.

Excelsior Spring Mattress. Chorlton & Dugdale, *Manchester.* LEAMINGTON, 1877.
*"Excelsior" Spring Mattress. Chorlton & Dugdale, *Manchester.* STAFFORD, 1878.
*"Excelsior" Spring Mattress Hospital Bed. Chorlton & Dugdale, *Manchester,* CROYDON, 1879.
*"Excelsior Spring" Mattress. Chorlton & Dugdale, *Manchester.* EXETER, 1880.
*"Excelsoir" Spring Mattresss. Chorlton & Dugdale, *Manchester.* NEWCASTLE, 1882.
*"Excelsior" Spring Mattress. Chorlton & Dugdale, *Manchester.* GLASGOW, 1883.
"Universal" Invalid Tubular Water and Air Bed. Pocock Bros., *Southwark Bridge Road.* STAFFORD, 1878.
*"Universal" Invalid Tubular Air and Water Bed. Pocock Bros., *Southwark Bridge Road, S.E.* CROYDON, 1879.

(3). Educational Appliances.

School Furniture. Colman & Glendenning, *Norwich.* EXETER, 1880.

(4). Domestic Appliances.

Invalid Furniture. J. Carter, 6*a*, *Cavendish Street, W.* EXETER, 1880.
Machine for Washing and Cooling Butter. F. & C. Hancock, *Dudley, Worcester.* LEAMINGTON, 1877.
*Machine for Washing and Cooling Butter. F. & C. Hancock, *Dudley, Worcester.* STAFFORD, 1878.
Exhibit of Machines for Domestic use. F. & C. Hancock, *Dudley, Worcestershire.* GLASGOW, 1883.

Arcanum Process of Silver Plating Steel. Jefferson Read, *Birmingham.* CROYDON, 1879.

(5). Foods.

No awards.

(6). Filters and Arrangements for Softening Water.

Filtre Rapide. P. A. Maignen, *Great Tower Street, E.C.* CROYDON, 1879.

*Filtre Rapide. P. A. Maignen, *Great Tower Street, E.C.* EXETER, 1880.

*Filtre Rapide. P. A. Maignen, *Great Tower Street.* GLASGOW, 1883.

Bischof's Spongy Iron Filter. Spongy Iron Water Purifying Company, *Oxford Street, W.C.* LEAMINGTON 1877.

(7). Mineral Waters.

No awards.

(8). Disinfectants.

Calvert's Carbolic Acid for disinfecting purposes. Calvert & Co., *Bradford, Manchester.* LEAMINGTON, 1877.

*Carbolic Acid. F. C. Calvert & Co., *Bradford.* CROYDON, 1879.

*Carbolic Acid and preparations of it. F. C. Calvert & Co., *Bradford.* EXETER, 1880.

*Carbolic Acid, and Preparations from it. F. C. Calvert & Co., *Manchester.* GLASGOW, 1883.

Little's Soluble Phenyle. Morris, Little & Co., *Doncaster,* STAFFORD, 1878.

Sanitas Oil. Sanitas Company (Limited), *London.* NEWCASTLE, 1882.

Chemical Preparations and Apparatus. Société Française D'Hygiène, *Paris.* LEAMINGTON, 1877.

(9). Disinfecting Apparatus.

Portable Disinfecting Apparatus. Fraser Bros., *Commercial Road, E.* CROYDON, 1879.

Acid Pump and Syphon. Chas. W. Walker, *Wandsworth Common.* CROYDON, 1879.

CLASS V.—MISCELLANEOUS.

Articles of Sanitary Interest not included in the above Classes, such as :—

(1). Scientific Instruments.

For Exhibit of Hospital and Sick Room Appliances. W. B. Hilliard & Sons, *Glasgow.* GLASGOW, 1883.

(2). Books on Sanitation.

Books on Hygiène. Société d'Hygiène, *Paris.* NEWCASTLE, 1882.
Sanitary Engineer of New York Newspaper. H. C. Meyer, *New York.* GLASGOW, 1883.

(3). Prevention of Accidents.

"Kredemnon" Life-saving Garments. F. Wentworth & Co., *London.* GLASGOW, 1883.

(4). Methods for the Disposal of the Dead.

No awards.

(5.) Sundries.

Ambulance Wheeled Litter. Maj. F. Duncan, *The Common, Woolwich.* STAFFORD, 1878.
Tyndall's Smoke Respirator. J. Sinclair, *Leadenhall Street, E.C.* CROYDON, 1879.

CERTIFICATES AWARDED AT THE EXHIBITIONS.

CLASS I.—CONSTRUCTION AND MACHINERY.

(1). Construction and Materials.

Adjustable Shoe and Regulating Spring Hinge for Swinging Doors. R. Adams, 7, *Great Dover Street, S.E.* CROYDON, 1879.

Fanlight Openers and Casement Fasteners. R. Adams, 7, *Great Dover Street, S.E.* CROYDON, 1879.

Granite Vitrified Bricks and Paving. Candy & Co., *Newton Abbot.* EXETER, 1880.

Glazing without Putty. Pennycook Patent Glazing & Engineering Company, *Glasgow.* GLASGOW, 1883.

Revolving Shutters, with Balance Weight Motion. Salmon, Barnes & Co., *Ulverston.* EXETER, 1880.

Hygeian Rock Building Composition. William White, *Abergavenny.* NEWCASTLE, 1882.

(2). Paints and other Protectives.

No award.

(3). Wall Papers.

"Lincrusta Walton." F. Walton & Co., *London.* GLASGOW, 1883.

(4). Decorative Materials.

Decorative Tiles for Covering Walls and Floors. Doulton & Co., *Lambeth, London.* CROYDON, 1879.

(5). Machinery adapted for Sanitary Purposes.

Improved Non-Absorbent Tub or Pail Van. J B. McCallum, *Stafford.* EXETER, 1880.

(6). Washing Machines.

"Vowel E." Bradford's Family Washing Machine. Garton & King, *Exeter.* EXETER, 1880.

Paragon Washing Machine with Canadian Washer. Kirsop & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Mitchell's Patent Steam Washer. James Mitchell, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

CLASS II.—SEWERAGE AND WATER SUPPLY.

(1). Water Closets.

Artizan Closet. Beard, Dent & Hellyer, 21, *Newcastle Street, W.C.* CROYDON, 1879.

Economical Flush-Out Closet. Doulton & Co., *Lambeth, London.* EXETER, 1880.

Flush-out Closet. Doulton & Co., *London.* NEWCASTLE, 1882.
"Lambeth" Flush-out Closet. Doulton & Co., *Lambeth, London.* GLASGOW, 1883.
"Lambeth" Trough Closet with Automatic Flush Tank. Doulton & Co., *Lambeth, London.* GLASGOW, 1883.
Improved Seat for Water Closets. E. & A. E. Gilbert, *Broughty Ferry, Forfarshire.* GLASGOW, 1883.
Fowler's Water-closet. W. Harriman & Co., *Blaydon-upon-Tyne.* NEWCASTLE, 1882.
"National" Water Closet. W. B. Morrison, *Glasgow.* GLASGOW, 1883.
"Clear Way" Regulator Valve Water Closet, without overflow communicating with Valve Box. J. Tylor & Sons, 2, *Newgate Street, E.C.* EXETER, 1880.
"National" Water Closet. Henry Watson & Son, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
"Crown" Cottage Water Closet. Henry Watson & Son, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

(2). Dry Closets.

Self-Acting Earth Closet. British Sanitary Company, *Glasgow.* EXETER, 1880.
Moser's Self-Acting Dry Closet. J. C. Onions (Limited), *Birmingham.* CROYDON, 1879.
Dry Earth Commode without Separator. J. Parker, *Woodstock.* EXETER, 1880.

(3). Urinals.

Flush-out Urinal Basin. J. Tylor & Sons, *London.* NEWCASTLE, 1882.

(4.) Sewage Treatment.

Iron Basket Sewage-strainer. T. Harnett Harrison, *Liverpool.* GLASGOW, 1883.
Pneumatic Liquid Ejector. Isaac Shone, *Wrexham.* STAFFORD, 1878.

(5). Traps.

Ventilating Drain Syphon. Beard, Dent & Hellyer, 21, *Newcastle Street, W.C.* CROYDON, 1879.
Disconnecting Drain Trap. W. P. Buchan, *Glasgow.* NEWCASTLE, 1882.
Disconnecting Drain Trap. W. P. Buchan, *Glasgow.* GLASGOW, 1883.
Grease Trap for Kitchen Sinks. W. P. Buchan, *Glasgow.* GLASGOW, 1883.
Buchan's Trap. J. & M. Craig, *Kilmarnock.* EXETER, 1880.
Buchan's Drain Trap and Drain-pipes, with Access Cover. J. & M. Craig, *Kilmarnock.* NEWCASTLE, 1882.

Exhibit of Stoneware Disconnecting Traps. J. & M. Craig, *Kilmarnock.* GLASGOW, 1883.

Disconnecting Gully, with back and side Entrances and iron grating. Doulton & Co., *Lambeth, London.* CROYDON, 1879.

Reversible Inlet Gully, with Dished Stoneware Cover and Iron Grating. Doulton & Co., *London.* NEWCASTLE, 1882.

Dean's External Drain Traps, with moveable receptacle. J. C. Edwards, *Trefynant Ruabon.* CROYDON, 1879.

Smith's Cast Lead Syphon Traps. J. Fell & Co., *Wolverhampton.* NEWCASTLE, 1882.

Hornibrook's Catchment Grating for Steep Gradients. Hammond & Hussey, *High Street, Croydon.* CROYDON, 1879.

"Eagle" Sanitary Trap, for superseding Bell Traps. Hygienic Stove and Grate Company, 15, *Peel Buildings, Birmingham.* CROYDON, 1879.

Edinburgh Air-Chambered Sewer Trap. Potts & Co., *Handsworth, Birmingham.* STAFFORD, 1878.

Dean's Gully Trap. Rimington Bros. & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Disconnecting Chamber for House Drains, with open Stoneware Channels. J. Stewart, Sen., *Glasgow.* GLASGOW, 1883.

Weaver's Ventilating Sewer Air Trap. James Stiff & Sons, *Lambeth, London.* STAFFORD, 1878.

(6). Sinks.

White Enamelled Fire Clay Sinks. J. & M. Craig, *Kilmarnock.* NEWCASTLE, 1882.

White Enamelled Fire Clay Sinks. J. & M. Craig, *Kilmarnock.* GLASGOW, 1883.

"Artizans' Dwellings Sink." G. Jennings, *Stangate, London.* CROYDON, 1879.

Swivel, Lock Plug, and Overflow for Sinks. Stidder & Co., 50, *Southwark Bridge Road, S E.* CROYDON, 1879.

Improved Enamelled Iron Slop Sink, with Regulator Supply Valve. J. Tylor & Sons, 2, *Newgate Street, E.C.* EXETER, 1880.

Hospital Slop Sink with Waste-not Regulator Valve. J. Tylor & Sons, *London.* NEWCASTLE, 1882.

Fire-Clay Sanitary Sinks, and Water Troughs. Willcock & Co., *Burmantofts, Leeds.* CROYDON, 1879.

(7). Baths and Lavatories.

Jennings's Universal Shampooing Apparatus. Dinning & Cooke, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Tip-up Lavatory Basin. Doulton & Co., *London.* NEWCASTLE, 1882.

Clark's Anti-splash Tip-up Lavatory Basin. J. Fell & Co., *Wolverhampton.* NEWCASTLE, 1882.

Lavatory. Gillow & Co., *Oxford Street, W.* STAFFORD, 1878.

Shower and Douche Bracket. Hayward, Tyler & Co., *London*. NEWCASTLE, 1882.

"Universal" Shampooing Apparatus. G. Jennings, *Stangate, London*. CROYDON, 1879.

Lavatory Basin with Flushing Rim. C. T. Maling, *Newcastle-upon-Tyne*, NEWCASTLE, 1882.

Sanitary Earthenware. C. T. Maling, *Newcastle-upon-Tyne*. NEWCASTLE, 1882.

Enamelled Fire Clay Bath. Rimington Bros., & Co., *Newcastle-upon-Tyne*, NEWCASTLE. 1882.

Porcelain Baths, moulded and glazed in one piece. Ruffard & Co., *Clay Works, Stourbridge*. STAFFORD, 1878.

Cast Iron Bath. Shanks & Co., *Glasgow*. GLASGOW, 1883.

Porcelain Lavatories, with moveable caps for access to fittings. Shanks & Co., *Glasgow*. GLASGOW, 1883.

"Eureka" Spray and Plunge Bath. Shanks & Co.. *Glasgow*. GLASGOW, 1883.

Flushing-rim Lavatory Basin with Quick Waste. J. Tylor & Sons, *London*. NEWCASTLE, 1882.

(8). Apparatus for Water Supply.

Syphon for Water Closet Cisterns. Braithwaite & Co., *Leeds*. CROYDON, 1879.

Anti-percussion High-pressure Bib Valves. Doulton & Co., *London*. NEWCASTLE, 1882.

Bath Locking Valves, for preventing waste of water. Doulton & Co., *London*. NEWCASTLE, 1882.

Latham's Flap Valve. Doulton & Co., *London*. NEWCASTLE, 1882.

Water-taps. J. Fell & Co., *Wolverhampton*. NEWCASTLE, 1882.

Large Way Waste Plug, with Protective Cover. Finch & Co., 181, *High Holborn, W.C.* CROYDON, 1879.

Hose Reel. Headley & Sons, *Cambridge*. CROYDON, 1879.

Improved Paragon Valve. W. Ross, *Glasgow*. GLASGOW, 1883.

Improved Full-Way Stop Valve. J. Tylor & Sons, 2, *Newgate Street, E.C.* EXETER, 1880.

"Waste Not" Regulator Valve. J. Tylor & Sons, 2, *Newgate Street, E.C.* EXETER, 1880.

Bath Locking Valves for preventing Waste of Water. J. Tylor & Sons, *London*. NEWCASTLE, 1882.

Waste-not Regulator Valve. J. Tylor & Sons, *London*. NEWCASTLE, 1882.

(9). Cisterns.

No awards.

(10). Flushing and Watering.

Waste-preventing Flushing Syphon. Henry Watson & Son, *Newcastle-upon-Tyne*. NEWCASTLE, 1882.

Syphon Flushing Cistern. Wright & Stevens. NEWCASTLE, 1882.

(11). Miscellaneous Sanitary Goods.

Air-tight Man-hole Door. A. T. Angell, *London.* NEWCASTLE, 1882.
Air-tight Man-hole Covers. A. T. Angell. *London.* GLASGOW, 1883.
Exhibit of Salt-glazed Fire-clay Sewer-pipes. J. Binnie, *Gartcosh, Glasgow.* GLASGOW, 1883.
Stoneware Pipes. Branksea Island Pottery Company (Limited), *Poole, Dorset.* EXETER, 1880.
Improved Drain-pipe with Access Cover. W. P. Buchan, *Glasgow.* NEWCASTLE, 1882.
Brian Jones's Joint for connecting Closet with Soil-pipe. Capper, Son, & Co., *London.* NEWCASTLE, 1882.
Maguire's Cradle Joint for Drain-pipes. J. & M. Craig, *Kilmarnock.* NEWCASTLE, 1882.
Cast Iron Channels for Stable Drainage. Dinning & Cooke, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Joint for Drain-pipes. Doulton & Co., *London.* NEWCASTLE, 1882.
Silicon Tread for Steps. Doulton & Co., *Lambeth, London.* GLASGOW, 1883.
Cotton Machine Belting. M. Gandy, *Liverpool.* GLASGOW, 1883.
Steil's Fastener for Machine Belting. M. Gandy, *Liverpool.* GLASGOW, 1883.
Drain-cleaning Rods, and Stoneware Horse Manger. Oates & Green, *Horley Green Fire Clay Works, Halifax.* STAFFORD, 1878.
Artificial Stone Tubes. Patent Victoria Stone Company, *Kingsland Road, E.* CROYDON, 1879.
Rock Concrete Tubes. Sharpe, Jones & Co., *Bourne Valley Pottery. Poole, Dorset.* CROYDON, 1879.
Large Fire-clay Drain-pipes. Straker & Love, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Cup Grating for Sinks. Thomasson & Key, *Worcester.* NEWCASTLE, 1882.
Joint for Lead Pipes. J. Tylor & Sons, *London.* NEWCASTLE, 1882.
Terry's Pedal-action for Water-closets. J. Tylor & Sons, *London.* NEWCASTLE, 1882.
Ransome's Artificial Stone Air Brick. Wippell Bros. & Row, 231. *High Street, Exeter.* EXETER, 1880.

CLASS III.—HEATING, LIGHTING AND VENTILATION.

(1). Heating Apparatus.

George's Calorigen. Dinning & Cooke, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Grates, Mantel-pieces, and Over-mantels. Dinning & Cooke, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Tortoise Slow Combustion Stoves. Hydes & Wigfield, *Sheffield.* GLASGOW, 1883.

Tortoise Laundry Stove. Hydes & Wigfield, *Sheffield.* GLASGOW, 1883.

Steam Heating Apparatus, combining heating and ventilating. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Warming and Ventilating Appliances. G. E. Pritchett, 20, *Spring Gardens, S.W.* STAFFORD, 1878.

Corrugated Iron Hot-Water Warming Appliances. G. E. Pritchett, 20, *Spring Gardens, S.W.* EXETER, 1880.

Open Grate for consuming Smoke. James Smith, *Liverpool.* NEWCASTLE, 1882.

Thermhydric Ventilating Hot-water Open Fire Grate. H. Saxon Snell, *Southampton Buildings.* STAFFORD, 1878.

Tubular-Calorifer for Greenhouses. William Thornburn, *Borough Bridge.* NEWCASTLE, 1882.

Conservatory Boiler, with Hot-Water Pipe. Wippell Bros. & Row, *Exeter.* EXETER, 1880.

"Cosey" Portable Open Gas Fire, with Platinum Wire and Asbestos Packing. John Wright & Co., *Birmingham.* NEWCASTLE, 1882.

(2). Cooking Apparatus.

Solid Flame Boiling Stove. Arden, Hill & Co., *Birmingham.* NEWCASTLE, 1882.

Combined Close Fire and Gas Cooking Range. Carron Co., *Falkirk.* GLASGOW, 1883.

"Sunlight Stove." Chorlton & Dugdale, 19, *Blackfriars Street. Manchester.* EXETER, 1880.

Devonshire Cooking Range. T. J. Constantine, *Fleet Street, E.C.* EXETER, 1880.

Tin Cooking Utensils. Mrs. A. Lewis, *Manchester.* CROYDON, 1879,

Dows' Close and Open Fire, Cooking Range. W. McGeoch & Co., *Glasgow.* GLASGOW, 1883.

Simplex Cooking Range. Walker, Turnbull & Co., *Falkirk.* GLASGOW, 1883.

Cooking Stove with Warm-Air Chamber, Thos. Waller, 47, *Fish Street Hill, E.C.* CROYDON, 1879.

Cottage Range. Wippell Bros. & Row, *Exeter.* EXETER, 1880.

(3). Lighting.

Improved Gas Burners. Bray & Co., *Blackman Lane, Leeds.* CROYDON, 1879.

Portable Gas Apparatus for Manufacturing Gas from Gasoline, F. W. Clarke's Portable Gas Apparatus Company (Limited), *Great Queen Street, W.C.* CROYDON, 1879.

Albo Carbon Light. William Forrest, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

Albo-Carbon Light. Osbert Henderson, *Glasgow.* GLASGOW, 1883.
Duplex Burner. T. Heron, *Manchester,* NEWCASTLE, 1882.
"Rheo-meter" Street Lamp Regulator. S. Leoni & Co., *Strand, W.C.* STAFFORD, 1878.
Hink's Duplex Lamp with Extinguisher. Mather & Armstrong, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
"Milwaukee" Glass Lantern or Hurricane Lantern. S. E, Ransome & Co., 10, *Essex Street, W.C.* CROYDON, 1879.
Gaseliers and Gas Brackets. Willey & Co., *Exeter.* EXETER, 1880.
Chappuis Daylight Reflector. Wippell Bros. & Row, 231, *High Street, Exeter.* EXETER, 1880.

(4). Ventilation.

Method of Costless Ventilation. Peter Hinckes Bird, 1, *Norfolk Square, W.* CROYDON, 1879.
Glass Revolving and Sliding Ventilators. H. W. Cooper & Co., *London.* GLASGOW, 1883.
NEWCASTLE, 1882.
Air Inlet Head for Drain Ventilation. H. S. Cregeen, *Bromley.*
"Radiator" Ventilator, with Screw Action. J. E. Ellison, *Leeds.* GLASGOW, 1883.
Double Current Ventilators. Hill & Hey, *Halifax.* GLASGOW, 1883.
Outlet Ventilator. C. Kite & Co. *London.* NEWCASTLE, 1882,
Noiseless Chimney Breast Outlet Ventilator. C. Kite & Co., *London.* GLASGOW, 1883.
Wall Inlet Ventilator. C. Kite & Co., *London.* GLASGOW, 1883.
"Imperial" Ventilating Window. U. Knell, 77, *Fore Street, E.C.* CROYDON, 1879.
Opener for Fanlight. W. & R. Leggott, *Bradford.* GLASGOW, 1883.
Morgan's Stench Exhaust. Nailsworth Foundry Company. *Bristol.* NEWCASTLE, 1882
Ornamental Inlet Ventilators. C. H. Sharp & Co., *High Holborn, E.C.* EXETER, 1880.
Boyle's Mica-Valved Outlet Ventilator. Wenham & Co., *Church Street, Croydon.* CROYDON, 1879.

CLASS IV.—PERSONAL HYGIENE, FOODS, AND DISINFECTANTS.

(1.) Clothing.

Ventilatorium Waterproof Garments. Bartrum, Harvey & Co., *London.* STAFFORD, 1878.

(2). Beds, &c.

Metallic Tubular Bedsteads and Invalid Bedrests. Thomas Allen, *St. Augustine's Parade, Bristol.* STAFFORD, 1878.
Folding Invalid Bed. Ancell Ball, *Spalding.* CROYDON, 1873.

Spring Mattresses. Billington Bros., *Liverpool.* GLASGOW, 1883.
Central Tube Water Mattress. Brady & Martin, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
Bed Rest with Movable Arms. Willam Brock & Co., 177, *Fore Street, Exeter.* EXETER, 1880.
"Nonsuch" Adjustable Chair. Willam Brock & Co., 177, *Fore Street, Exeter.* EXETER, 1880.
Spring Mattress. Bussey & Co., *Museum Works, Peckham, S.E.* CROYDON, 1879.
"Invalid's" Adjustable Bed. Chorlton & Dugdale, *Manchester.* EXETER, 1880.
"Excelsior" Ships' Berth. Chorlton & Dugdale, *Manchester.* GLASGOW, 1883.
Automaton Seat for Drapers. Colman & Glendenning, *Norwich.* EXETER, 1880.
Spring Mattress. A. Gardner & Son, *Glasgow.* GLASGOW, 1883.
Parquet Flooring. A. Gardner & Co., *Glasgow.* GLASGOW, 1883.
Self-acting Sick Bed. E. K. Groves, *Bristol.* GLASGOW, 1883
"Grasshopper" Couch. W. Hamilton, *Brighton.* STAFFORD, 1878.
Invalid "Grasshopper" Couch. William Hamilton, *Brighton.* NEWCASTLE, 1882.
Fernby's "Paragon" Camp Furniture. Wippell Bros. & Row, *Exeter.* EXETER, 1880.

(3). Educational Appliances.

School Desks with Shifting Seats. Colman & Glendenning, *Norwich.* STAFFORD, 1878.
Dual Desk, with Separate Gangway Seat Thomas Larmouth & Co. *Salford.* STAFFORD, 1878.

(4). Domestic Appliances.

Automatic Chariot for Children. William Bowden, *London,* NEWCASTLE, 1882.
Compostella Fire Lights for Lighting Fires. Compostella Fire Light Company, *Fenchurch Street, E.C.,* STAFFORD, 1878.
Stoneware Churns. F. Grosvenor, *Glasgow.* GLASGOW, 1883.
Dough Kneading Machine. F. & C. Hancock, *Dudley, Worcester.* EXETER, 1880
New Propellor Churn. F. & C. Hancock, *Dudley, Worcester.* EXETER, 1880.
Machine for Washing and Peeling Potatoes. F. & C. Hancock, *Dudley.* NEWCASTLE, 1882.
Pendulous Food Warmers. Osbert Henderson, *Glasgow.* GLASGOW, 1883.
Various Inventions for Promoting Domestic Economy. W. H. Hilton, *Leamington.* STAFFORD, 1878.
India Rubber Gas Tubing. A. Hutchinson & Co., *Great Winchester Street, E.C.* EXETER, 1880.
India Rubber Vessels for hospital use. H. A. Murton, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.
China Cups and other Vessels for invalid use. Townsend & Co., *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

"Noiseless Ware." Vernon's Patent China and Glass Company. *London.* GLASGOW, 1883.
Improved Housemaid's Box with Sifter. Wippell Bros. & Row, *High Street, Exeter.* EXETER, 1880.

(5). Foods.

Currie Powders. J. Edmunds, *London.* NEWCASTLE, 1882.
Cocoa Extract and Preparations of Chocolate. J. S. Fry & Sons, *Union Street, Bristol.* EXETER, 1880.
Mustard. Irvine & Co., *Gateshead.* NEWCASTLE, 1882.

(6). Filters and Arrangements for Softening Water.

"Bijou" Filtre Rapide. P. A. Maignen, *Great Tower Street, E.C.* EXETER, 1880.
Improved Filtre Rapide. P. A. Maignen, *Great Tower Street, E.C.* NEWCASTLE, 1882.
Silicated Carbon Double Chambered Table Filters. Silicated Carbon Filter Company, *Battersea.* EXETER, 1880.
Silicated Carbon Filtering Material. Silicated Carbon Filter Company, *London.* NEWCASTLE, 1882.
Carbonised Iron Stone Mound Filter for Water. J. A. Stephan, *Worcester.* EXETER, 1880.
Artificial Stone Filters, for Cleansing Rain Water for Domestic Use. Thorn & Co., *Stafford.* STAFFORD, 1878.

(7). Mineral Waters.

Potash, Soda and Seltzer Waters and Lemonade. British Mineral Water Company, *Glasgow.* NEWCASTLE, 1882.
Preparations of Lime Juice, Aromatic Ginger Ale, and Quinine Tonic. Carter & Co., *Old Refinery, Bristol.* EXETER, 1880.
Zoedone. (Patentee David Johnson, F.C.S.) Evans & Co., *Wrexham.* CROYDON, 1879.
Lemonade, Lime Juice, and Ginger Ale. Gulliver & Co., *Aylesbury.* CROYDON, 1879.
Seltzer Water. Jewsbury & Brown, *Manchester.* STAFFORD, 1878.
Ginger Ale and Lemonade. Newry Mineral Water Company (Limited), *Liverpool.* CROYDON, 1879.
Seltzer, Soda, and Potash Waters, and Orange Quinine Tonic G. H. Skinner, 13, *North Street, Exeter.* EXETER, 1880.

(8). Disinfectants.

Red Cross Yellow Fluid. Antiseptic Apparatus Manufacturing Co., *London.* NEWCASTLE, 1882.
Jeyes' Perfect Purifier. Jeyes' Sanitary Compound Company. *Bishopsgate Street, E.C.* CROYDON, 1879.
Jeyes' Perfect Purifier. Jeyes' Sanitary Compound Company, *London.* NEWCASTLE, 1882.
Jeyes' Disinfecting Fluid. Jeyes' Sanitary Compound Co., *London and Glasgow.* GLASGOW, 1883.

(9) Disinfecting Apparatus.

Improved Vaporiser for Disinfecting. F. C. Calvert & Co., *Bradford.* EXETER, 1880.

Dr. Scott's Disinfecting Apparatus. Maguire & Son, *Dublin* NEWCASTLE, 1882.

Lyon's Disinfector. Manlove, Alliott, Fryer & Co., *Nottingham.* NEWCASTLE, 1882.

CLASS V.—MISCELLANEOUS.

Articles of Sanitary Interest not included in the above Classes, such as :—

(1). Scientific Instruments.

Large Legible Spirit Thermometer. P. Hinckes Bird, 1, *Norfolk Square, N.W.* EXETER, 1880.

Instruments used by Medical Officers of Health. Brady & Martin, *Newcastle-upon-Tyne.* NEWCASTLE, 1882.

New Oven Pyrometer. Joseph Davis & Co., *London,* NEWCASTLE, 1882.

Burn and Wound Boxes. W. B. Hilliard & Sons, *Glasgow.* GLASGOW, 1883.

Isolating Curtain. W. B. Hilliard & Sons, *Glasgow.* GLASGOW, 1883.

Thermometrical Instruments. G. E. Pritchett, 20, *Spring Gardens, S.W.* STAFFORD, 1878.

Barometrical and Thermometrical Instruments. G. E. Pritchett, 20, *Spring Gardens, S.W.* CROYDON, 1879.

Improvements in Thermometrical and Barometrical Instruments. G. E. Pritchett, 20, *Spring Gardens, S.W.* EXETER, 1880.

Webster's Photometer. Webster & Co., *Nottingham.* CROYDON, 1879.

(2). Books on Sanitation.

Exhibit of Drawings and Books Relating to Disposal of Sewage in Paris. A. Durand Claye, *Paris.* GLASGOW, 1883.

Publications. Ladies' Sanitary Association, *Berners Street, W.* STAFFORD, 1878.

Sanitary Publications. Smith, Elder, & Co., *London.* NEWCASTLE, 1882.

Sanitary Publications. Smith, Elder & Co., *London.* GLASGOW, 1883.

(3). Prevention of Accidents.

Safety Belt Shippers. Selig, Sonnenthal & Co. (Limited), *Lambeth Hill, Queen Victoria Street, E.C.* CROYDON, 1879,

Chemical Fire Exterminator. J. Sinclair, 104, *Leadenhall Street, E.C.* CROYDON, 1879.

(4). Methods for the Disposal of the Dead.

"Earth to Earth" Coffins. London Necropolis Company, *Strand, W.C.* STAFFORD, 1878.

Folding Bier and Car for Simplifying Funerals. S. Stretton, *Kidderminster.* CROYDON, 1879.

ALPHABETICAL LIST OF MEDALS AWARDED AT THE EXHIBITIONS.

RICHARDSON MEDAL.

Messrs. Mather & Armstrong, *Newcastle-upon-Tyne*, for Siemens's Regenerative Gas Burner. NEWCASTLE, 1882.

Silicate Paint Company, *Cannon Street, E.C.*, for Griffiths' Patent White. STAFFORD, 1878.

SILVER MEDAL.

Offered by the Exeter Gas Company.

Sanitary and Economic Supply Association, for Dr. Bond's Euthermic Ventilating Gas Stove. EXETER, 1880.

MEDALS AND SPECIAL CERTIFICATES.

Exhibits which have already received Medals at previous Exhibitions of the Institute are excluded from award of Medals; but those Exhibits to which a second Medal would otherwise be awarded receive Special Certificates, and these are distinguished in the following list by asterisks.

Aluminium Crown Metal Co., *Glasgow* .for Aluminium Crown Metal, GLASGOW, 1883.

Aveling & Porter, *Rochester*, for Improved Six-Ton Steam Road Roller. CROYDON, 1879.

Bean, A. T., 5, *Cannon Row, S.W.*, for Direct Acting Valveless Waste Preventer. EXETER, 1880.

Billing & Co., *Hatton Garden, E.C.*, for Apparatus for Cooking by Gas. STAFFORD, 1878.

*Billing & Co., *Hatton Garden, E.C.*, for "Workman's" Cooking Stove, and other Improvements in Gas-Cooking Stoves. CROYDON, 1879.

Borwell, J., *Britannia Foundry, Burton-on-Trent*, for Improved Washer, with table complete. LEAMINGTON, 1877.

Bostel, D. T., *Duke Street, Brighton*, for Excelsior Water Closet. LEAMINGTON, 1877.

*Bostel, D. T., *Duke Street, Brighton*, for "Excelsior" Water Closet. STAFFORD, 1878.

Bradford, T. & Co., *High Holborn, W.C.*, for New "Shuttle" Steam Power Washing Machine. LEAMINGTON, 1877.

*Bradford, Thomas & Co., *Salford*, for Shuttle Steam-Power Washing Machine. STAFFORD, 1878.

Bradford, Thomas & Co., *London.*, for Washing Machines. NEWCASTLE, 1882

*Bradford & Co., *Manchester*, for Washing Machines. GLASGOW, 1883.
British Sanitary Company, *Glasgow*, for Dry Earth Closet. NEWCASTLE, 1882.
*British Sanitary Co., *Glasgow*, for Improved Self-acting Earth Closets. GLASGOW, 1883.
*Brown, A. & Co., *Glasgow*, for "Stott" Gas Burner GLASGOW, 1883.
Buchan, W. P., *Glasgow*, for Sanitary Appliances. GLASGOW, 1883.
Calvert & Co., *Bradford*, for Calvert's Carbolic Acid for disinfecting purposes. LEAMINGTON, 1877.
*Calvert, F. C., & Co., *Bradford*, for Carbolic Acid. CROYDON, 1879.
*Calvert, F. C., & Co., *Bradford*, for Carbolic Acid and preparations of it. EXETER, 1880.
*Calvert, F. C., *Bradford*, for Carbolic Acid, and Preparations from it. GLASGOW, 1883.
Carter, J., 6*a*, *Cavendish Street*, *W.*, for Invalid Furniture. EXETER, 1880.
Chorlton & Dugdale, *Manchester*, for Excelsior Spring Mattress. LEAMINGTON, 1877.
*Chorlton & Dugdale, *Manchester*, for "Excelsior" Spring Mattress. STAFFORD, 1878.
*Chorlton & Dugdale, *Manchester*, for "Excelsior" Spring Mattress Hospital Bed. CROYDON, 1879.
*Chorlton & Dugdale, *Manchester*, for "Excelsior" Spring Mattress. EXETER, 1880.
*Chorlton & Dugdale, *Manchester*, for "Excelsior" Spring Mattress. NEWCASTLE, 1882.
*Chorlton & Dugdale, *Manchester*, for "Excelsior Spring Mattress. GLASGOW, 1883.
Cliff, Joseph & Sons, *Leeds*, for Porcelain Bath. GLASGOW, 1883.
Colman & Glendenning, *Norwich*, for School Furniture. EXETER, 1880.
Dick, Alex., *London*, for Delta Metal. GLASGOW, 1883.
Doulton & Co., *Lambeth*, *London*, for Stanford's Joints for Stone-ware Pipes. STAFFORD, 1878.
Doulton & Co., *Lambeth*, *London*, for Anti-Percussion High Pressure Valves. CROYDON, 1879.
*Doulton & Co., *Lambeth*, *London*, for Anti-Percussion High Pressure Draw-off Valves. EXETER, 1880.
*Doulton & Co., *Lambeth*, *London*, for Stanford's Joints for Stone-ware Pipes. EXETER, 1880.
Doulton & Co., *Lambeth*, *London*, for Ventilating Tile Stove. EXETER, 1880.
Doulton & Co., *Lambeth*, *London*, for Anti-Percussion Ball Valve. NEWCASTLE, 1882
*Doulton & Co., *London*, for Ventilating Tile Stoves. NEWCASTLE, 1882.
*Doulton & Co., *Lambeth*, *London*, for "Anti-Percussion High-pressure Valves. GLASGOW, 1883.
*Doulton & Co., *Lambeth*, *London*, for Ventilating Tile Stove. GLASGOW, 1883.
Duncan, Maj. F., *The Common*, *Woolwich*, for Ambulance Wheeled Litter. STAFFORD, 1878.
Ellison, J. E., *Leeds*, for Conical Ventilators. STAFFORD, 1878.

*Ellison, J. E., *Victoria Square, Leeds*, for Conical Ventilators. CROYDON, 1879.

*Ellison, J. E., *Leeds*, for Conical Ventilators. GLASGOW, 1883.

Fraser Bros., *Commercial Road, E.*, for Portable Disinfecting Apparatus. CROYDON, 1879.

Galbraith, T., *Crawford Square, Londonderry*, for Hot-Air Bath. LEAMINGTON, 1877.

Hall, John & Co., *Stourbridge*. for Fire-Clay Enamelled Bath. GLASGOW, 1883.

Hamilton & Co., *Leadenhall Street, E.C.*, for Prismoidal Pavement and Floor Lights. CROYDON, 1879.

Hancock, F. & C., *Dudley, Worcester*, for Machine for Washing and Cooling Butter. LEAMINGTON, 1877.

*Hancock, F. & C., *Dudley, Worcester*, for Machine for Washing and Cooling Butter. STAFFORD, 1878.

Hancock, F. & C., *Dudley, Worcester*, for Machines for Domestic use. GLASGOW, 1883.

Haresceugh, B. B. & Co., *Bentinck Street, Leeds*, for Excreta Pail (oak) with Spring Lid. LEAMINGTON, 1877.

*Haresceugh, B. B. & Co., *Leeds*, for Excreta Pail (oak) with Spring Lid. STAFFORD, 1878.

Harris, G. H., *Bristol Street, Birmingham*, for Economical Cooking Range. LEAMINGTON, 1877.

*Harris, G. H., *Bristol Street, Birmingham*, for Economical Cooking Range. STAFFORD, 1878.

Hassall & Singeton, *Birmingham*, for Phœnix Portable Range, and the Birmingham Range with Reducible Fire without Gas. STAFFORD, 1878.

Hayward, Tyler & Co., *London*, for Full-flush Valveless Closet. NEWCASTLE, 1882.

Heap, R. R., *Manchester*, for Dry Earth or Ashes Closet. GLASGOW, 1883.

Hilliard, W. B. & Sons, *Glasgow*, for Hospital and Sick Room Appliances. GLASGOW, 1883.

Hunt, Nathan, *Bristol*, for Auto-Pneumatic Ventilation. EXETER, 1880.

Keith, J., *London and Edinburgh*, for Challenge Hot-water Boiler. GLASGOW, 1883.

Lascelles, W. H., *Bunhill Row, E.C.*, for Concrete Bath in one piece. CROYDON, 1879.

*Lascelles, W. H., *Bunhill Row, E.C.*, for Concrete Bath, in one piece. EXETER, 1880.

Le Grand & Sutcliffe, *Bunhill Row, E.C.*, for Improvements in Well Sinking Apparatus. LEAMINGTON, 1877.

*Le Grand & Sutcliffe, 100, *Bunhill Row*, for Improvements in Internal driving of Tube Wells. CROYDON, 1879.

Leoni, S. & Co., *Strand*, for Apparatus for Cooking by Gas. STAFFORD, 1878.

Maignen, P. A., 20 & 23, *Great Tower Street, E.C.*, for Filtre Rapide. CROYDON, 1879.

*Maignen, P.A., 20 & 23, *Great Tower Street, E.C.*, for Filtre Rapide. EXETER, 1880.

*Maignen, P. A., 20 & 23, *Great Tower Street, E.C.*, for Filtre Rapide. GLASGOW, 1883.

Manlove, Alliot, Fryer & Co., *Nottingham*, for Fryer's Destructor, Fryer's Carbonizer, and Firman's Dessicating and Rendering Apparatus. NEWCASTLE, 1882.

Mather & Armstrong, *Newcastle-upon-Tyne*, for Sieman's Regenerative Gas Burner. NEWCASTLE, 1882.

Meyer, H. C., *New York*, Sanitary Engineer of New York Newspaper. GLASGOW, 1883.

Moore, J., *St. James' Walk, Clerkenwell, E.C.*, for Glass Louvre Ventilators. EXETER, 1880.

Morris, Little & Co., *Doncaster*, for Little's Soluble Phenyle. STAFFORD, 1878.

Morrison, W.B., *Glasgow*, for Wedgwood Ornamental Tiles. GLASGOW, 1883

Moser, L., *Southampton.*, for Dry Closet, suitable for Ashes or Disinfecting Powder. EXETER, 1880.

Moule's Patent Earth Closet Company, 5*a*, *Gairrick Street, W.C.*, for Earth Closets. STAFFORD, 1878.

*Moule's Patent Earth Closet Company (Limited), 5*a*, *Garrick Street, W.C.*, for Earth Closet. CROYDON, 1879.

Orr, J. B. & Co., *Charlton, London*, for Leadless "Charlton White" Paint and Dryers. GLASGOW, 1883.

Parker, J., *Woodstock, Oxford*, for Dry Earth Closet. LEAMINGTON, 1877.

Pocock, Bros., *Southwark Bridge Road*, for "Universal" Invalid Tubular Water and Air Bed. STAFFORD, 1878.

*Pocock Bros., *Southwark Bridge Road, S.E.*, for "Universal" Tubular Air and Water Bed. CROYDON, 1879.

Pritchett,, G. E., 20, *Spring Gardens, S.W.*, for Economic Hollow Flooring. STAFFORD, 1878.

*Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Improvements in Hollow Tile Flooring. CROYDON, 1879.

Read, Jefferson, *Birmingham*, for Arcanum Process of Silver Plating Steel. CROYDON, 1879.

Roberts, C. G., *Haslemere, Bucks.*, for Rain-water Separator. NEWCASTLE, 1882.

*Roberts, C. G., *Haslemere, Surrey*, for Automatic Rain-water Separator. GLASGOW, 1883.

Ross, J. A. G., *Newcastle-upon-Tyne*, for Silicate Cotton (Slag-wool). NEWCASTLE, 1882.

Sanitary Appliance Company, *Salford*, for Portable Cinder Sifting Ash Closet, with Soil Pail. STAFFORD, 1878.

*Sanitary Appliance Company, *Factory Lane, Salford*, for Patent Cinder-Sifting Ash Closet. CROYDON, 1879.

Sanitary & Economic Supply Association, *Gloucester*, for Dr. Bond's Euthermic Gas Stove. EXETER, 1880.

Sanitas Company (Limited), *London*, for Sanitas Oil. NEWCASTLE, 1882.

Scottish Asbestos Co., *Glasgow*, for Scottish Asbestos. GLASGOW, 1883.

Shaw, A. & Son, *Glasgow*, for "Sine quâ non" Open and Close Fire Range. GLASGOW, 1883.

Silicate Paint Company, *Cannon Street, E.C.*, for Griffiths' White, and for their preparations of Silicate Paint, Enamel Paint, and Petrifying Liquids. STAFFORD, 1878.

Sinclair, J., *Leadenhall Street, E.C.*, for Tyndall's Smoke Respirator. CROYDON, 1879

Société Française D'Hygiène, *Paris*, for Chemical Preparations and Apparatus. LEAMINGTON, 1877.

Société Française D'Hygiène, *Paris*, for Books on Hygiène. NEWCASTLE, 1882.

Spongy Iron Water Purifying Company, *Oxford Street, W.C.*, for Bischof's Spongy Iron Filter. LEAMINGTON, 1877.

Stewart, J., Sen., *Glasgow*, for Stoneware Disconnecting Traps. GLASGOW, 1883.

*Stewart, J., Sen., *Glasgow*, for Stoneware Pipes with Stanford's Joint. GLASGOW, 1883.

Stott, James & Co., *Oldham*, for Mercury Gas Governor. NEWCASTLE, 1882.

Tylor & Sons, *Newgate Street, E.C.*, for Flushing Rim Lavatory Basin and Apparatus. EXETER, 1880.

Walker, Chas. W., *Wandsworth Common*, for Acid Pump and Syphon. CROYDON, 1879.

Walker, Turnbull & Co., *Falkirk*, for Artizan Cooking Range. GLASGOW, 1883.

Ward, O. D., *London*, for Household Water Closet. NEWCASTLE, 1882.

*Ward, O. D., *London*, for Bean's Direct Acting Valveless Waste Preventor. NEWCASTLE, 1882.

Webb, H. Clark, *Worcester*, for Colouring Patterns through the Substance of Wood. EXETER, 1880.

Wenham, W. P., *Church Street, Croydon*, for Improved Open or Close Range Kitchener. CROYDON, 1879.

Wentworth, F. & Co., *London*, for "Kredemnon" Life-saving Garments. GLASGOW, 1883.

Whyte & Bradford, *Bowness*, for Cooking Range with Revolving Fire for the Prevention of Smoke. GLASGOW, 1883.

Wilkinson, W. B. & Co., *Newcastle-upon-Tyne*, for Damp-proof Concrete Pavement. NEWCASTLE, 1882.

Willcocks & Co., *Burmantofts, Leeds*, for Silica Glazed and Enamelled Fire Clay Bricks and Fäience. CROYDON, 1879.

Wilson Engineering Company, *Holborn, W.C.*, for Wilson Portable Close Cooking Range. EXETER, 1880.

Wilson Engineering Company, *London*, for Improved Wilson Range. with Steel Boiler & non-conducing Jacketting. NEWCASTLE, 1882.

*Wilson Engineering Co., *London*, for "Wilson Cooking Range." GLASGOW, 1883.

*Wippell Bros. & Row, 231, *High Street, Exeter*, for Moule's Earth Closet. EXETER, 1880.

Woollams & Co., *High Street, Marylebone*, for Paper Hangings free from Arsenic. CROYDON, 1879.

*Woollams & Co., *London*, for Non-Arsenical Wall Papers. NEWCASTLE, 1882,

ALPHABETICAL LIST OF CERTIFICATES AWARDED AT THE EXHIBITIONS.

Adams, R., 7, *Great Dover Street, S.E.*, for Adjustable Shoe, and Regulating Spring Hinge for Swinging Doors. CROYDON, 1879.

Adams, R., 7, *Great Dover Street, S.E.*, for Fanlight Openers and Casement Fasteners. CROYDON, 1879.

Allen, Thomas, *St. Augustine's Parade, Bristol*, for Metallic Tubular Bedsteads and Invalid Bedrests. STAFFORD, 1878.

Angell, A. T., *London*, for Air-tight Man-hole Door. NEWCASTLE, 1882.

Angell, A. T,, *London*, for Air-tight Man-hole Covers. GLASGOW, 1883.

Antiseptic Apparatus Manufacturing Co. (Limited), for Red Cross Yellow Fluid. NEWCASTLE, 1882.

Arden, Hill & Co., *Birmingham*, for Solid Flame Boiling Stove. NEWCASTLE, 1882.

Ball, Ancell, *Spalding*, for Folding Invalid Bed. CROYDON, 1879.

Bartrum, Harvey, & Co., *London*, for Ventilatorium Waterproof Garments. STAFFORD, 1878.

Beard, Dent, & Hellyer, 21, *Newcastle Street, W.C.*, for Artizan Closet. CROYDON, 1879.

Beard, Dent, & Hellyer, 21, *Newcastle Street, W.C.*, for Ventilating Drain Syphon. CROYDON, 1879.

Billington Bros., *Liverpool*, for Spring Mattresses. GLASGOW, 1883.

Binnie, J., *Gartcosh, Glasgow*, for Salt-glazed Fire-clay Sewer Pipes. GLASGOW, 1883.

Bird, Peter Hinckes, 1, *Norfolk Square, N.W.*, for Method of Costless Ventilation. CROYDON, 1879.

Bird, Peter Hinckes, 1, *Norfolk Square, N.W.*, for Large Legible Spirit Thermometer. EXETER, 1880.

Bowden, William, *London*, for Automatic Chariot for Children. NEWCASTLE, 1882.

Brady & Martin, *Newcastle-upon-Tyne*, for Central Tube Water Mattress. NEWCASTLE, 1882.

Brady & Martin, *Newcastle-upon-Tyne*, for Instruments used by Medical Officers of Health. NEWCASTLE, 1882.

Braithwaite & Co., *Leeds*, for Syphon for Water Closet Cisterns. CROYDON, 1879.

Branksea Island Pottery Company (Limited), *Pool, Dorset*, for Stoneware Pipes. EXETER, 1880.

British and Foreign Mineral Water Company, *Glasgow*, for Potash, Soda and Seltzer Waters, and Lemonade. NEWCASTLE, 1882.

British Sanitary Company, *Glasgow*, for Self-Acting Earth Closet. EXETER, 1880.

Brock, W. & Co., 177, *Fore Street*, *Exeter*, for Bed Rest with Moveable Arms. EXETER, 1880.

Brock, William & Co., 177, *Fore Street*, *Exeter*, for "Nonsuch" Adjustable Chair. EXETER, 1880.

Bray & Co., *Blackman Lane*, *Leeds*, for Improved Gas Burners. CROYDON, 1879.

Buchan, W. P., *Glasgow*, for Improved Drain-pipe, with Access Cover. NEWCASTLE, 1882.

Buchan, W. P., *Glasgow*, for Disconnecting Drain-trap. NEWCASTLE, 1882.

Buchan, W. P., *Glasgow*, for Disconnecting Drain Trap. GLASGOW, 1883

Buchan, W. P., *Glasgow*, for Grease Trap for Kitchen Sinks. GLASGOW, 1883.

Bussey & Co., *Museum Works*, *Peckham*, *S.E.*, for Patent Spring Mattress. CROYDON, 1879.

Calvert, F. C., & Co., *Bradford*, for Improved Vaporiser for Disinfecting. EXETER, 1880.

Candy & Co., *Newton Abbot*, for Granite Vitrified Bricks and Paving. EXETER, 1880.

Capper, Son & Co., *London*, for Brian Jones's Joint for connecting Closet with Soil-pipe. NEWCASTLE, 1882.

Carron Company, *Falkirk*, for Combined Close Fire and Gas Cooking Range. GLASGOW, 1883.

Carter & Co., *Old Refinery*, *Bristol*, for Preparations of Lime Juice, Aromatic Ginger Ale, and Quinine Tonic. EXETER, 1880.

Chorlton & Dugdale, *Manchester*, for "Sun-light Stove." EXETER, 1880.

Chorlton & Dugdale, *Manchester*, for "Invalids'" Adjustable Bed. EXETER, 1880.

Chorlton & Dugdale, *Manchester*, for "Excelsior" Ships' Berth. GLASGOW, 1883.

Clarke, F. W., Portable Gas Apparatus Company (Limited), *Great Queen Street*, *W.C.*, for Portable Gas Apparatus for Manufacturing Gas from Gasoline. CROYDON, 1879.

Colman & Glendenning, *Norwich*, for School Desks with Shifting Seats. STAFFORD, 1878.

Colman & Glendenning, *Norwich*, for Automaton Seat for Drapers. EXETER, 1880.

Compostella Fire-Light Company, *Fenchurch Street*, *E.C.*, for Compostella Fire Lights for Lighting Fires. STAFFORD, 1878.

Constantine, T. J., *Fleet Street*, *E.C.*, for Devonshire Cooking Range. EXETER, 1880.

Cooper, H. W. & Co., *London*, for Glass Revolving and Sliding Ventilators. GLASGOW, 1883.

Craig, J. & M., *Kilmarnock*, for Buchan's Trap. EXETER, 1880.

Craig, J. & M., *Kilmarnock*, for Maguire's Cradle Joint for Drain-pipes. NEWCASTLE, 1882.

Craig, J. & M., *Kilmarnock*, for Buchan's Drain-trap and Drain-pipes, with Access Cover. NEWCASTLE, 1882.

Craig, J. & M., *Kilmarnock*, for White Enamelled Fire-Clay Sinks. NEWCASTLE, 1882.

Craig, J. & M., *Kilmarnock*, for Stoneware Disconnecting Traps. GLASGOW, 1883.

Craig, J. & M., *Kilmarnock*, for White Enamelled Sinks. GLASGOW, 1883.

Cregeen, H. S., *Bromley*, for Air Inlet Head for Drain Ventilation. NEWCASTLE, 1882.

Davis, Joseph & Co., *London*, for New Oven Pyrometer. NEWCASTLE, 1882.

Dinning & Cooke, *Newcastle-upon-Tyne*, for Cast Iron Channels for Stable Drainage. NEWCASTLE, 1882.

Dinning & Cooke, *Newcastle-upon-Tyne*, for George's Calorigen. NEWCASTLE, 1882.

Dinning & Cooke, *Newcastle-upon-Tyne*, for Jennings's Universal Shampooing Apparatus. NEWCASTLE, 1882.

Dinning & Cooke, *Newcastle-upon-Tyne*, for Grates, Mantel-pieces, and Over-mantels. NEWCASTLE, 1882.

Doulton & Co., *Lambeth, London*, for Decorative Tiles for Covering Walls and Floors. CROYDON, 1879.

Doulton & Co., *Lambeth, London*, for Disconnecting Gully, with back and side Entrances and iron grating. CROYDON, 1879.

Doulton & Co., *Lambeth, London*, for Economical Flush-Out Closet. EXETER, 1880.

Doulton & Co., *London*, for Anti-Percussion High-pressure Bib Valves. NEWCASTLE, 1882.

Doulton & Co., *London*, for Bath Locking Valves, for preventing waste of water. NEWCASTLE, 1882.

Doulton & Co., *London*, for Latham's Flap Valve. NEWCASTLE, 1882.

Doulton & Co., *London*, for Joint for Drain-pipes. NEWCASTLE, 1882.

Doulton & Co., *London*, for Reversible Inlet Gully, with Dished Stoneware Cover and Iron Grating. NEWCASTLE, 1882.

Doulton & Co., *London*, for Flush-out Closet. NEWCASTLE, 1882.

Doulton & Co., *London*, for Tip-up Lavatory Basin. NEWCASTLE, 1882.

Doulton & Co., *Lambeth, London*, for "Lambeth" Trough Closet with Automatic Flush Tank. GLASGOW, 1883.

Doulton & Co., *Lambeth, London*, for "Lambeth" Flush-out Closet. GLASGOW, 1883.

Doulton & Co. *Lambeth, London*, for Silicon Tread for Steps. GLASGOW, 1883.

Durand Claye, A., *Paris*, for Drawings and Books Relating to Disposal of Sewage in Paris. GLASGOW, 1883.

Edmunds, J., *London*, for Currie Powders. NEWCASTLE, 1882.

Edwards, J. C., *Trefynant, Ruabon*, for Dean's External Drain Traps, with moveable receptacle. CROYDON, 1879.

Ellison, J. E., *Leeds*, for "Radiator" Ventilator, with Screw Action. GLASGOW, 1883.

Evans & Co., *Wrexham* for Zoedone. (Patentee David Johnson, F.C.S.) CROYDON, 1879.

Fell, J. & Co., *Wolverhampton*, for Clark's Anti-splash Tip-up Lavatory Basin. NEWCASTLE, 1882.
Fell, J. & Co., *Wolverhampton*, for Smith's Cast Lead Syphon Traps. NEWCASTLE, 1882.
Fell, J. & Co., *Wolverhampton*, for Water-taps. NEWCASTLE, 1882.
Finch & Co., 181, *High Holborn*, *W.C.*, for Large Way Waste Plug, with Protective Cover. CROYDON, 1879.
Forrest, William, *Newcastle-upon-Tyne*, for The Albo Carbon Light. NEWCASTLE, 1882.
Fry, J. S. & Sons, *Union Street*, *Bristol*, for Cocoa Extract and Preparations of Chocolate. EXETER, 1880.
Gandy, M., *Liverpool*, for Cotton Machine Belting. GLASGOW, 1883.
Gandy, M., *Liverpool*, for Steil's Fastener for Machine Belting. GLASGOW, 1883.
Gardner, A. & Son, *Glasgow*, for Spring Mattress. GLASGOW, 1883.
Gardner, A. & Son, *Glasgow*, for Parquet Flooring. GLASGOW, 1883.
Garton & King, *Exeter*, for Vowel E. Bradford's Family Washing Machine. EXETER, 1880.
Gilbert, E. & A. E., *Broughty Ferry*, *Forfarshire*, for Improved Seat for Water Closets. GLASGOW, 1883.
Gillow & Co., *Oxford Street*, *W.*, for Lavatory. STAFFORD, 1878.
Groves, E. K., *Bristol*, for Self-acting Sick Bed. GLASGOW, 1883.
Grosvenor, F., *Glasgow*, for Stoneware Churns. GLASGOW, 1883.
Gulliver & Co., *Aylesbury*, for Lemonade, Lime Juice, and Ginger Ale. CROYDON, 1879.
Hamilton, W., *Brighton*, for Invalid "Grasshopper" Couch. STAFFORD, 1878.
Hamilton, William, *Brighton*, for Invalid "Grasshopper" Couch. NEWCASTLE, 1882.
Hammond & Hussey, *High Street*, *Croydon*, for Hornibrook's Catchment Grating for Steep Gradients. CROYDON, 1879.
Hancock, F. & C., *Dudley*, *Worcester*, for New Propellor Churn. EXETER, 1880.
Hancock, F. & C., *Dudley*, *Worcester*, for Dough Kneading Machine. EXETER, 1880.
Hancock, F. & C., *Dudley*, for Machine for Washing and Peeling Potatoes. NEWCASTLE, 1882.
Harriman, W., & Co., *Blaydon-upon-Tyne*, for Fowler's Water-closet. NEWCASTLE, 1882.
Harrison. T. Harnett, *Liverpool*, for Iron Basket Sewage-strainer. GLASGOW, 1883.
Hayward, Tyler & Co., *London*, for Shower and Douche Bracket. NEWCASTLE, 1882.
Headley & Sons, *Cambridge*, for Hose Reel. CROYDON, 1879.
Henderson, Osbert, *Glasgow*, for Albo-Carbon Light. GLASGOW, 1883.
Henderson, Osbert, *Glasgow*, for Pendulous Food Warmers. GLASGOW, 1883.
Heron, T., *Manchester*, for Duplex Burner. NEWCASTLE, 1882.
Hilliard, W. B. & Sons, *Glasgow*, for Isolating Curtain. GLASGOW, 1883.

Hilliard, W. B. & Sons, *Glasgow*, for Burn and Wound Boxes. GLASGOW, 1883.

Hill & Hey, *Halifax*, for Double Current Ventilators. GLASGOW, 1883.

Hilton, W. H., *Leamington*, for various Inventions for Promoting Domestic Economy. STAFFORD, 1878.

Hutchinson, A. & Co., *Great Winchester Street, E.C.*, for India Rubber Gas Tubing. EXETER, 1880.

Hydes & Winfield, *Sheffield*, for Tortoise Slow Combustion Stoves. GLASGOW, 1883.

Hydes & Winfield, *Sheffield*, for Tortoise Laundry Stove. GLASGOW, 1883.

Hygienic Stove and Grate Company, 15, *Peel Buildings, Birmingham*, for "Eagle" Sanitary Trap, for superseding Bell Traps. CROYDON, 1879.

Irvine & Co., *Gateshead*, for Mustard. NEWCASTLE, 1882.

Jennings, G., *Stangate, London*, for "Artizans Dwellings Sink." CROYDON, 1879.

Jennings, G., *Stangate, London*, for Universal Shampooing Apparatus. CROYDON, 1879.

Jewsbury & Brown, *Manchester*, for Seltzer Water. STAFFORD, 1878.

Jeyes' Sanitary Compound Company, *Bishopsgate Street, E.C.*, for Jeyes' Perfect Purifier. CROYDON, 1879.

Jeyes' Sanitary Compound Company, *London*, for Jeyes' Perfect Purfier. NEWCASTLE, 1882.

Jeyes' Sanitary Compound Co., *London and Glasgow*, for Jeyes' Disinfecting Fluid. GLASGOW, 1883.

Kirsop & Co., *Newcastle-upon-Tyne*, for Paragon Washing Machine, with Canadian Washer. NEWCASTLE, 1882.

Kite, C. & Co. *London*, for Outlet Ventilator. NEWCASTLE, 1882.

Kite, C. & Co., *London*, for Noiseless Chimney Breast Outlet Ventilator. GLASGOW, 1883.

Kite, C. & Co.. *London*, for Wall Inlet Ventilator. GLASGOW, 1883.

Knell, U., 77, *Fore Street, E.C.*, for "Imperial" Ventilating Window. CROYDON, 1879.

Ladies' Sanitary Association, *Berners Street, W.*, for Publications. STAFFORD, 1878.

Larmouth, Thomas & Co., *Salford*, for Dual Desk, with Separate Gangway Seat. STAFFORD, 1878.

Leggott, W. & R., *Bradford*, for Opener for Fanlight. GLASGOW, 1883.

Leoni, S. & Co., *Strand, W.C.*, for "Rheometer" Street Lamp Regulator, STAFFORD, 1878.

Lewis, Mrs. A., *Manchester*, for Tin Cooking Utensils. CROYDON, 1879.

London Necropolis Company, *Strand, W.C.*, for "Earth to Earth" Coffins. STAFFORD, 1878.

McCallum, J. B., *Stafford*, for Improved Non-Absorbent Tub or Pail Van. EXETER, 1880.

McGeoch, W. & Co., *Glasgow*, for Dow's Close and Open Fire Cooking Range. GLASGOW, 1883.

Maguire & Son, *Dublin*, for Dr. Scott's Disinfecting Apparatus. NEWCASTLE, 1882.

Maignen, P. A., 20 & 23, *Great Tower Street, E.C.*, for "Bijou" Filtre Rapide. EXETER, 1880.

Maignen, P. A., 20 & 23, *Great Tower Street, E.C.*, for Improved Filtre Rapide. NEWCASTLE. 1882.

Maling, C. T., *Newcastle-upon-Tyne*, for Sanitary Earthenware. NEWCASTLE, 1882.

Maling, C. T., *Newcastle-upon-Tyne*, for Lavatory Basin with Flushing Rim. NEWCASTLE, 1882.

Manlove, Alliott, Fryer & Co., *Nottingham*, for Lyon's Disinfector. NEWCASTLE, 1882.

Mather & Armstrong, *Newcastle-upon-Tyne*, for Hink's Duplex Lamp, with Extinguisher. NEWCASTLE, 1882.

Mather & Armstrong, *Newcastle-upon-Tyne*, for Steam Heating Apparatus, combining heating and ventilating. NEWCASTLE, 1882.

Mitchell, James, *Newcastle-upon-Tyne*, for Mitchell's Steam Washer. NEWCASTLE, 1882.

Morrison, W. B., *Glasgow*, for "National" Water Closet. GLASGOW, 1883.

Murton, H. A., *Newcastle-upon-Tyne*, for Indiarubber Vessels for hospital use. NEWCASTLE, 1882.

Nailsworth Foundry Company, *Bristol*, for Morgan's Stench Exhaust. NEWCASTLE, 1882.

Newry Mineral Water Company (Limited), *Liverpool*, for Ginger Ale and Lemonade. CROYDON, 1879.

Oates & Green, *Horley Green Fire Clay Works, Halifax*, for Drain-cleaning Rods, and Stoneware Horse Manger. STAFFORD, 1878.

Onions, J. C., (Limited), *Birmingham*, for Moser's Self-Acting Dry Closet. CROYDON, 1879.

Parker, J., *Woodstock*, for Dry Earth Commode without Separator. EXETER, 1880.

Patent Victoria Stone Company, *Kingsland Road, E.*, for Artificial

Pennycook Patent Glazing and Engineering Co., *Glasgow*, for Glazing Stone Tubes. CROYDON, 1879.
without Putty. GLASGOW, 1883.

Potts & Co., *Handsworth, Birmingham*, for Edinburgh Air-Chambered Sewer Trap. STAFFORD, 1878.

Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Warming and Ventilating Appliances. STAFFORD, 1878.

Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Thermometrical Instruments. STAFFORD, 1878.

Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Barometrical and Thermometrical Instruments. CROYDON, 1879.

Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Corrugated Iron Hot-Water Warming Appliances. EXETER, 1880.

Pritchett, G. E., 20, *Spring Gardens, S.W.*, for Improvements in Thermometrical and Barometrical Instruments. EXETER, 1880.

Ransome, S. E., & Co., 10, *Essex Street, W.C.*, for "Milwaukee" Glass Lantern or Hurricane Lantern. CROYDON, 1879.

Rimington Bros. & Co., *Newcastle-upon-Tyne*, for Dean's Gully Trap. NEWCASTLE, 1882.

Rimington Bros. & Co. *Newcastle-upon-Tyne*, for Enamelled Fire Clay Bath. NEWCASTLE, 1882.

Ross, W., *Glasgow*, for Improved Paragon Valve. GLASGOW, 1883.

Ruffard & Co., *Clay Works*, *Stourbridge*, for Porcelain Baths, moulded and glazed in one piece. STAFFORD, 1878.

Salmon, Barnes & Co., *Ulverston*, for Revolving Shutters with Balance Weight Motion. EXETER, 1880.

Selig, Sonnenthal & Co. (Limited), *Lambeth Hill*, *Queen Victoria Street*, *E.C.*, for Safety Belt Shippers. CROYDON, 1879.

Shanks & Co., *Glasgow*, for Cast Iron Bath. GLASGOW, 1883.

Shanks & Co., *Glasgow*, for Porcelain Lavatories, with moveable caps for access to fittings. GLASGOW, 1883.

Shanks & Co., *Glasgow*, for "Eureka" Spray and Plunge Bath. GLASGOW, 1883.

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SIR ANTONIO BRADY.	President Section		III.	EXETER,	1880.
DR. ALFRED CARPENTER.	,,	,,	I.	CROYDON,	1879.
PROF. F. S. B. F. DE CHAUMONT, M.D., F.R.S.	,,	,,	I.	EXETER,	1880.
DENNIS EMBLETON, M.D., F.R.C.S.	,,	,,	I.	NEWCASTLE,	1882.
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G. J. SYMONS, F.R.S.	,,	,,	III.	CROYDON,	1879.

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1883. May. BLASHILL, Thomas, 10, *Old Jewry Chambers, E.C.*

1881. Nov. *BOND, Frederick Adolphus, M.B., C.M. EDIN., S.SC. CERT. EDIN., *Brinklow, Coventry.*

1877. .... BOSTEL, D. T., 19, *Duke Street, Brighton.*

1878. Oct. BOSTOCK, H., *The Oaklands, Rowley Avenue, Stafford.*

1880. Nov. †*BOULNOIS, H. Percy, M.INST.C.E., *Borough Engineer Portsmouth.*

1877. Oct. BOWER, Thomas, *Lytham, Lancashire.*

1876. July. BRETT, A. T., M.D., *Watford House, Herts.*

1881. Jan. BROOKS, James, F.R.I.B.A., 35, *Wellington Street, Strand.*

1876. July. BROWN, P., M.D., *Blaydon House, Blaydon-on-Tyne.*

1883. Sept. BURNET, John, 167, *St. Vincent Street, Glasgow.*

1883. Sept. *BURNET, John James, *St. Kilda Dowanhill Gardens, Glasgow.*

1876. .... BURNS, R. Scott, C.E., *Oak Lea, Edgeley Road, Stockport.*

1880. Dec. †*BURTON, W. Kinninmond, 1, *Adam Street, Adelphi, W.C.*

1878. Oct. BUTLER, G. J., *Shrewsbury.*

1876. Aug. CARLINE, John, ASSOC.M.INST.C.E., *Lewisham Board of Works, S.E.*

1882. Jan. CARRITT, Ernest, 18 & 19, *Great St. Helens, E.C.*

1881. May. CHESTON, Horace, A.R.I.B.A., 1, *Great Winchester Street, London, E.C.*

1883. Feb. CHRISTIE, James, A.M., M.D., 2, *Great Kelvin Terrace, Hillhead, Glasgow.*

1880. Jan. COLLINGRIDGE, W., M.A., M.D., S.SC. CERT. CAMB., *Port of London Sanitary Offices, Greenwich.*

1878. Sept. COLLINS, SIR W., 3, *Park Terrace, East Glasgow.*

1876. .... COLLINS, W. J., M.D., 1, *Albert Terrace, N.W.*

1883. June. †*COMBER, P. F., 4, *Prince of Wales Terrace, Bray, Ireland.*

1882. Nov. †*COOPER, C. H., A.M.INST.C.E., A.R.C.SC.I., *Local Board Offices, Wimbledon.*

1878. Sept. CORBETT, J., 24, *Barton Arcade, Manchester.*

1883. May. CROMBIE, James, *The Butts, Brentford.*

1877. Sept. CROWLEY, Frederick, *Ashdell, Alton, Hants.*

1883. June. CUTLER, Thomas William, 5, *Queen Square, Bloomsbury.*

1877. Oct. ‡DAVIES, Hugh, 1, *Hill Street, Wrexham.*

1881. Oct. DAY, Ernest, 5, *Foregate Street, Worcester.*

1878. May. DENNIS, W., M.INST.C.E., 3, *Victoria Street, Westminster.*

1877. July. DODD, J., 6, *Thomas Street, Liverpool.*

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1876. Dec. DOWSON, A., ASSOC.M.INST.C.E., 3, *Great Queen Street, Westminster, S.W.*

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1883. Sept. *FAWCETT, William Milner, M.A., F.R.I.B.A., 1, *Silver Street, Cambridge.*

1878. June. FORSHAW, Edward, *Bank Chambers, Hanley.*

1879. Dec. *FOSTER, Reginald Le Neve, F.C.S., *North Road, Droylsdon, Manchester.*

1878. July. FRY, Miss C. A., *St. Catherine's, Oxford.*

1883. Oct. GAIRDNER, PROF. W.T., M.D., LL.D., *The College, Glasgow.*

1878. .... GENTLES, Thomas Lawrie, L.F.P.S. GLASG., *Wellington House, Derby.*

1878. June. GILL, D., *Farleigh, Weston-super-Mare.*

1878. Oct. GRIFFITHS, Robert, *County Surveyor, Stafford.*

1878. July. GRIFFITHS, Thomas, 10, *King's Road, Clapham, S.W.*

1878. Mar. GRIGGS, R., 11, *Gray's Inn Square, W.C.*

1877. Aug. HAMILTON, SIR, R. N. C., K.C.B., *Avon Cliffe, Stratford-on-Avon.*

1881. June. HAMMOND, Frederick, 2, *Coleman Street Buildings, Moorgate Street, E.C.*

1876. July. HARKER, THE REV. W.

1880. Nov.†‡*HARLAND, A., A.R.I.B.A., P.A.S.I., 170, *Stanhope Street, N.W.*

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1877. Sept. HARRISON, C., M.D., S.SC. CERT. CAMB., *Newland, Lincoln.*

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1876. July. HARTLEY, R., L.R.C.P. EDIN., *Pemberton, Wigan, Lancashire.*

1883. Nov. HINTON, James Thomas, M.D. MUNICH, 38, *High Street, Croydon.*

1878. May. HOLT, H. P., ASSOC.M.INST.C.E., F.G.S., *Fairlea, Palatine Road, Didsbury, Manchester, and* 5 *Westminster Chambers, S.W.*

1878. July. HOOKER, J., F.C.S., 104, *Upper Thames Street, E.C.*

1877. July. HOOPER, Rev. R. P., M.A., F.R.G.S., 31, *Cambridge Road, Hove, Brighton.*

1877. Mar. HOWARD, E., 84, *Upper Whitecross Street, E.C.*

1882. June. †*HUBBER, Frank, *George Street, Exeter.*

1878. Mar. HUMPHRY, PROF. G. M., M.D., F.R.S., *Cambridge.*

1878. June. HUSBAND, H. Aubrey, M.R.C.S., M.B., C.M., B.SC. PUB. HEALTH EDIN., 27, *Chalmers Street, Edinburgh.*

1878. Sept. HYDE, Samuel, M.R.C.S., *Clifford Lodge, Buxton.*

1877. June. ILIFFE, W., M.R.C.S., *Hartington Street, Derby.*

1878. Sept. INGILBY, SIR Henry D., BART., 9, *Hereford Gardens, Park Lane, W.*

1883. Nov. JACOB, Edward Long, B.A. LOND., M.R.C.S , 8, *Altenburg Gardens, Clapham Common, S.W.*

1883. July. JONES, Thomas Inman, 8, *Townsend, Beaumaris.*

1882. July. JONES, John Watkin, *Maesyffynon, Tonalaw, near Pont-y-pridd, South Wales.*

1883. Dec. *KELLY, Charles, M.D., M.B., F.R.C.P., *Broadwater Road, Worthing.*

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1878. May. LAW, Henry, M.INST.C.E., 5, *Queen Anne's Gate, S.W.*

1878. July. LAWSON, R., *Lansdowne Road, Notting Hill.*

1877. Oct. LAYTON, Thomas, *Kew Bridge, Middlesex.*

1878. Oct. LEE, John, *Church Street, Ashbourne.*

1883. Dec. LEE, R. J., M.D., 1, *Saville Row, W.*

1876. July. LE GRAND, A., 100, *Bunhill Row, E.C.*

1878. Oct. LEMON, James, M.INST.C.E., F.R.I.B.A., *Lansdowne House, Southampton.*

1877. .... LEON, George I., 1, *First Avenue, Hove, Brighton.*

1880. Dec. *LINGARD, J. Edward, ASSOC.M.INST.C.E., *Rodney Chambers, Derby.*

1877. July. LLOYD, Thomas, *The Square, Winchester.*

1882. Apr. LYTE, F. Maxwell, F.C.S., F.I.C., *Union Club, Trafalgar Square.*

1878. July. MCARTHUR, A., M.P., *Raleigh Hall, Brixton Rise.*

1882. Oct. MCCARTHY, J. Desmond, M.D., F.C.S., F.R.G.S., *Darlington; and Largos, West Africa.*

1879. July. MACFARLANE, Walter, *Saracen Foundry, and 22, Park Circus, Glasgow.*

1878. Nov. MACKEY, John B., 2, *Bouverie Street, Fleet Street, E.C.*

1878. Oct. MACLAGAN, James McGrigor, M.D., *Riding-Mill-on-Tyne, Northumberland.*

1883. May. †*MAGUIRE, William Robert, 10, *Dawson Street, Dublin, and Town Hill, Dalkey, Co. Dublin.*

1878. May. MANSERGH, James, M.INST.C.E., 3, *Westminster Chambers, Victoria Street, S.W.*

1878. Oct. MARTEN, H. J., M.INST.C.E., *The Birches, Codsall, Wolverhampton.*

1878. Sept. MARTIN, J. M., C.E., *Castle Chambers, Exeter.*

1878. Sept. MASON, Hugh H., M.R.C.S., *Abbey Lodge, Barking.*

1883. Nov, MASTERS, Henry, 18, *Maridian Place, Clifton, Bristol*

1883. June.†*MAWBEY, E. G., BOROUGH SURVEYOR, *King's Lynn.*

1876. .... MEGGET, A., 7, *Huntris Row, Scarborough.*

1878. .... MEIKLEJOHN, J., *Dalkeith, N.B.*

1877. Oct. MELISSENOS, G. C. A., Melisurgo, ASSOC.M.INST.C.E., *Palazzo Cocozzo*, 76, *Via Pocrio, Naples.*

1878. Sept. MILLER, John Faure, M.D., 28, *Rue de Matignon, Faubourg St. Honoré, Paris.*

1873. June. MOORE, J. H., *St. Michael's Lodge, Bournemouth.*

1883. Jan. MORCOM, Augustus, L.R.C.S., *Montpelier House, Dunstable, Beds.*

1879. Feb. *MOSELEY, George, F.R.C.S., 27, *Willbury Road, Hove, Brighton.*

1882. Oct. *MYNORS, Walter Charles Towers, *Little Ingestre, Stafford.*

1882. Apr. NANSON, Thomas, 9, *Park Crescent, Stockwell Park Road, S.E.*

1877. Sept. NELSON, E. M., *Hanger Hill House, Ealing.*

1877. Sept. NELSON, George H., *The Lawn, Warwick.*

1878. Sept. NICHOLS, G. B., C.E., *Handsworth, Birmingham.*

1876. July. NIXON, Charles J., *Addiscombe, Cranborne Road, Bournemouth.*

1878. May. NORMAN, W. S., 13, *Warwick Road, W.*

1881. Mar. *PAGE, Herbert Markant, M.D., S.SC. CERT. CAMB., M.R.C.S., 16, *Prospect Hill, Redditch.*

1877. .... PAGLIARDINI, T., 75, *Upper Berkeley Street, Portman Square, W.*

1878. May. PARKER, J., *Woodstock.*

1877. .... PARKER, W. C., M.INST.C.E., *Whitehall Club, S.W.*

1883. Oct. PARKES, Louis Coltman, M.D., 51, *Cadogan Square, S.W.*

1878. .... PATTINSON, S., *Ruskington, Sleaford, Lincoln.*

1877. June. PEEL, Edmund, *Brynfys Ruabon, North Wales.*

1882. Jan. PERRY, Henry Robert, A.R.I.B.A., *Oak Cottage, Western Bank, Derby.*

1881. June. PERRY, John Tavenor, 9, *John Street, Adelphi.*

1883. Nov. PHILPOT, Charles William, M.D. LOND., 58, *North End, Croydon.*

1879. Dec. *POWELL, George Thompson, *Rotherwood, Sydenham Hill, and* 11, *Pancras Lane, E.C.*

1877. .... *POWELL, J., 10, *St. George's Crescent, Liverpool.*

1878. June. PRITCHARD, E., M.INST.C.E., F.G.S., 2, *Storey's Gate, Westminster, S.W., and* 37, *Waterloo Street, Birmingham.*

1877. .... PRITCHETT, G. E., F.S.A., 20, *Spring Gardens, S.W., and Oak Hall, Bishop's Stortford.*

1877. Aug. PULLIN, T. H. S., M.D., *Sidmouth.*

1877. Sept. RAE, Robert, 337, *Strand, W.C.*

1881. Jan. RAINGER, Charles Henry, 9, *Bath Place, Cheltenham.*

1883. Dec. RAWLINSON, Sir Robert, C.B., *Local Government Board, Whitehall.*

1876. July. REDWOOD, T. Hall, M.D., *The Lawn, Rhymney.*

1881. June. REED, Frederick H., A.R.I.B.A., 10, *Belmont Hill, Lee, S.E.*

1878. Oct. RUSSELL, J. B., M.D., *Medical Officer of Health, Glasgow,*

1878. July. SANDYS, MAJOR M., 87, *Jermyn Street, S.W.*

1881. July. SCHMIDT, E. W. C. F., A.R.I.B.A., *Eastbourne, Sussex.*

1876. Oct. SHAFTESBURY, RT. HON. EARL OF, K.G., 24, *Grosvenor Square, W.*

1876. July. SHONE, Isaac, ASSOC.M.INST.C.E., *Wrexham.*

1878. Oct. SHRIMPTON, Charles, M.D. PARIS, 11, *Willswood Park, Torquay.*

1877. .... SILLAR, W. C., *St. James' Lodge, Kidbrooke Park Road, Blackheath, S.E.*

1883. Oct. SIMPSON, PROF. P. A., M.D., *The College, Glasgow.*

1882. Nov. SIMPSON, William John, M.D., S.SC.CERT.CAMB., 110, *Crown Street, Aberdeen.*

1878. Nov. SKRINE, Henry Duncan, *Claverton Manor, Bath.*

1877. .... SLADE-KING, Edwyn, M.D., LIC. IN STATE MED.R.C.P. EDIN., *Croft Side, Ilfracombe.*

1883. Mar. SLATER, John, B.A., 14, *Bedford Row, W.C.*

1877. June. SMITH, R. W., *Mount Rundell Harborne, Birmingham.*

1877. May. SMITH, W. R., *Clifton House, Clifton-by-Ashbourne Derbyshire.*

1878. Oct. SPRUCE, Samuel, *Beech House, Tamworth.*

1878. July. STAINTHORPE, W. Waters, M.D., S.SC. CERT. EDIN., *Kirkleatham, Redcar.*

1876. July. STIFF, E., *London Pottery, Lambeth.*

1883. Dec. STRONG, Henry J., M.D., 64, *North End, Croydon.*

1876. July. SUTCLIFFE, R., 100, *Bunhill Row, E.C.*

1877. Sept. SWETE, Horace, M.D., S.SC. CERT. CAMB., F.C.S., *The Grove, Worcester.*

1880. Jan. *SYKES, J. F. J., B.SC. PUB. HEALTH, M.B., L.R.C.P., M.R.C.S., 7, *Thayer Street, Manchester Square.*

1876. Oct. TAYLOR, John W., M.D., D.SC., *Rothsay House, Scarboro'.*

1881. Nov. TAYLOR, Shepherd T., M.B. LOND., L.R.C.P., M.R.C.S., *Grove House, Norwich.*

1877. .... TEMPLETOWN, GEN. RIGHT HON. VISCOUNT, K.C.B., 49, *Charles Street, Berkeley Square.*

1878. July. THOMAS, W. Cave, 53, *Welbeck Street, W.*

1878. .... THORNLEY, J. E., *Lyndon, Bickenhill near Birmingham.*

1883. Dec. TREW, J. Fletcher, *Lyndon House, Park End Road, Gloucester.*

1878. Oct. TROTTER, Arthur E. H., *Stockton-on-Tees.*

1879. July. TYLOR, William Alfred, 2, *Newgate Street, E.C.*

1882. July. VIGERS, Edward, A.R.I.B.A., F.S.I., 38, *Parliament Street, S.W., and 79, Elgin Road, Paddington.*

1877. June. WALKER, J. H., L.R.C.P. EDIN., *Pickering, Yorkshire.*

1877. Sept. WALLER, Thomas, 47, *Fish Street Hill, E.C.*

1881. May. WEBB, Phillip, 1, *Raymond Buildings, Gray's Inn, W.C.*

1878. Oct. WELFORD, J., 4, *Warwick Place, Paddington, W.*

1880. May. WHITE, William, F.S.A., F.R.I.B.A., 30A, *Wimpole St., W.*

1877. Sept. WHITWILL, Mark, *Redland House, Durdham Park, Bristol.*

1878. July. ‡WILKINSON, William, *Town Hall, Salford.*

1883. July. *WILLIAMS, Owen, 5, *The Crescent, Bangor.*

1881. July. *WITHERS, J. B. Mitchell, F.R.I.B.A., 5, *Surrey Street, Sheffield.*

1882. July. †‡*WITTS, J. W., *Market Harborough.*

1877. Sept. WOOD, Jacob, M.P.S., 186, *Highbury Park, N.*

1878. Sept. *YUILL, W., ASSOC.M.INST.C.E., 3, *Fenchurch Avenue, E.C.*

ASSOCIATES [32].

* Life Associates. ‡ Passed Examination for Inspectors of Nuisances.

1883. Sept. AITKEN, Charles, 7, *Dynevor Gardens, Richmond.*

1881. May. BAMLETT, Adam Carlisle, *Thirsk, Yorkshire.*

1882. June. ‡*BAXTER, John, 2, *Walnut Tree Walk, Kennington Road, S.E.*

1879. Dec. *BLAKE, Edward Thomas, M.D., 47, *Seymour Street, Hyde Park, W.*

1879. Aug. BOLDING, John T., 19, *South Moulton Street, W.*

1883. Oct. BUCHAN, W. Paton, *Fairyknowe, Cambuslang, Lanarkshire, N.B.*

1883. Nov. BUCHANAN, Kenneth Hugh, 8, *Wilson Street, Derby.*

1883. Dec. BURNS, J. Cleland, *Park Gardens, Glasgow.*

1879. Nov. ‡*CLARKE, A. Lennox, *Union Buildings, Selly Oak, King's Norton.*

1883. Dec. ‡*CROGHAN, Thomas Andrew, 37, *Devonshire Gardens, Buxton.*

1882. Mar. DENSHAM, Charles A., 55, *Cochrane Street, St. John's Wood.*

1880. Feb. EMPTAGE, Daniel, *Dane Hill Sanitary Works, Margate.*

1882. Oct. GODDARD, Frederick K., *Newcastle-on-Tyne.*

1883. Sept. ‡*HEARNE, William, 26, *Fermoy Road, Paddington.*

1883. Oct. HONEYMAN, John, F.R.I.B.A., 7, *Blythswood Square, Glasgow.*

1881. Nov. ‡*HORROCKS, Joseph.

1883. Dec. ‡*KEMSLEY, Jesse, *Rodwell Villa, Rodwell Road, East Dulwich, S.E.*

1882. Feb. KENNINGTON, Thomas, 47, *Sheffield Sanitary Company, Moorhead, Sheffield.*

1880. Feb. KINSEY, W. Barns, 5, *Carteret Street, Westminster.*

1879. Nov. ‡*LAPWORTH, J., *Vestry Hall, Bethnal Green, E.*

1883. Nov. ‡*LEGG, S. C., 62, *Gayhurst Road, Dalston, E.*

1882. July. ‡*LIGHTFOOT, Thomas, 3, *Trevor Square, Knightsbridge.*

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1881. Nov. ‡*RAINS, Joseph, *Kettering.*

1882. Nov. ‡*RICHARDS, Daniel, 3, *Spencer Street, Park Road, Battersea.*

1881. Nov. ‡*SORTWELL, W., 9, *Retreat Place, Paragon Road, Hackney, E.*

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1883. Oct. Stewart, James, Sen., 25, *Lynedoch Street, Glasgow.*
1883. Jan. Wallis, Arthur Gay, 45, *Gough Road, Edgbaston.*
1883. Feb. Welch, Henry, M.B., B.SC. EDIN., 4, *Queen Street, Lancaster.*
1883. June.‡*Wells, G. F., 37, *Prospect Street, Hull.*
1881. June.‡*Wilkinson, W., 48, *Canning Street, Bury.*

SUBSCRIBERS [16].

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1879. Sept. Bourne, Stephen, *Atherley, Wallington, Surrey.*
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1879. June. Coles, Cowper, C.B., 95, *Wigmore Street, W.*
1879. Apr. Denham, W. Hempson, F.L.S., F.S.S., *Southsea.*
1881. Jan. Dixon, Joshua, *Winslade, Exeter.*
1880. .... Domenichetti, Richard, M.D., *Trinity Lodge, Louth. Lincolnshire.*
1877. Sept. Fleetwood, The Local Board of.
1879. Mar. Goodall, Abraham, F.R.C.S., F.R.G.S., INSP.-GENL., 4, *Elvaston Place, Queen's Gate.*
1877. .... Ladies' Sanitary Association, 22, *Berners Street, Oxford Street, W.*
1879. .... Middleton, Reginald E., ASSOC.M.INST.C.E., *Larburnam House, South Queen's Ferry, N.B.*
1877. .... Rivers Purification Association, 232, *Gresham House, E.C.*
1878. Oct. Southport, The Mayor and Corporation of.
1877. Sept. Tottenham Sanitary Association, *High Cross, Tottenham.*
1879. Feb. Wallace, Miss, 6, *Hyde Park Gardens.*

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Zymotic diseases, propagation of 101 102, 103, 109, 305

When tested in London in 1890 Ventilator excelled fakers' Cowls and t 94,000 feet in 21 ie Champion.

Disconnecting and Ventilating Drain Traps. Also, Grease Traps, Access-Pipes, Fire-Clay Slop Stones, &c., for Drains.

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Prize Medal Grease Trap, for Kitchen Sinks, &c. Prevents chokage of the Drain with Grease.

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UCHAN, M S.A., Assoc. San. Inst.,
ire-clay, from the Makers, J. & M.
s from the Makers, ROBT. BROWN &
mmittee of the Sanitary Institute
, Sept. 25th to Oct. 20th, 1883.

For the awards given by the Institute see Appendix, pages (21) and (22).

For the awards given by the Institute see Appendix, page (26).

LINCRUSTA-WALTON.

The Sunbury Wall Decoration.

This Beautiful Material has been Greatly Reduced in Price, owing to Improvements in the Manufacture.

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LINCRUSTA-WALTON has obtained TEN PRIZE MEDALS, and has been used in numerous Mansions and Clubs, and in most of the leading Hotels; has also been adopted by the London and North-Western, Midland, Great Eastern, Lancashire and Yorkshire, and other Railway Companies; also by H.M. Vessels, the P. and O. Steamers, the Cunard, White Star, Inman, and other Steamship Lines.

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For the awards given by the Institute see Appendix, page (19).

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INCLUDING

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HOUSE DRAINAGE CARRIED OUT ON THE MOST SANITARY PRINCIPLES.

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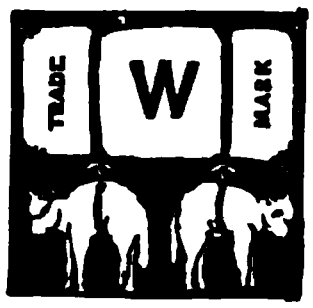

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N.B.—**A Prize Medal was awarded by the Sanitary Institute of Great Britain** in 1879. for "Paper Hangings free from Arsenic," after an exhaustive examination by their Analysts of a large number of Samples cut from Pattern Books extending over a series of ten years; and we also received an "Award of Merit" from the Judges at the International Medical and Sanitary Congress, 1881, and a Special Certificate at Newcastle for similar papers.

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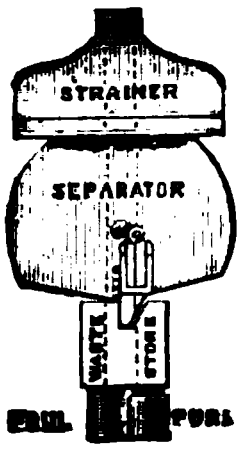
Medal awarded by Sanitary Institute, 1882; and Special Certificate awarded by Sanitary Institute, 1883.



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E. WHITE WALLIS.

For the awards given by the Institute see Appendix, page (32).

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For the awards given by the Institute see Appendix, pages (23) and (33).

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